ELECTRICAL TIMES

THURSDAY
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1952
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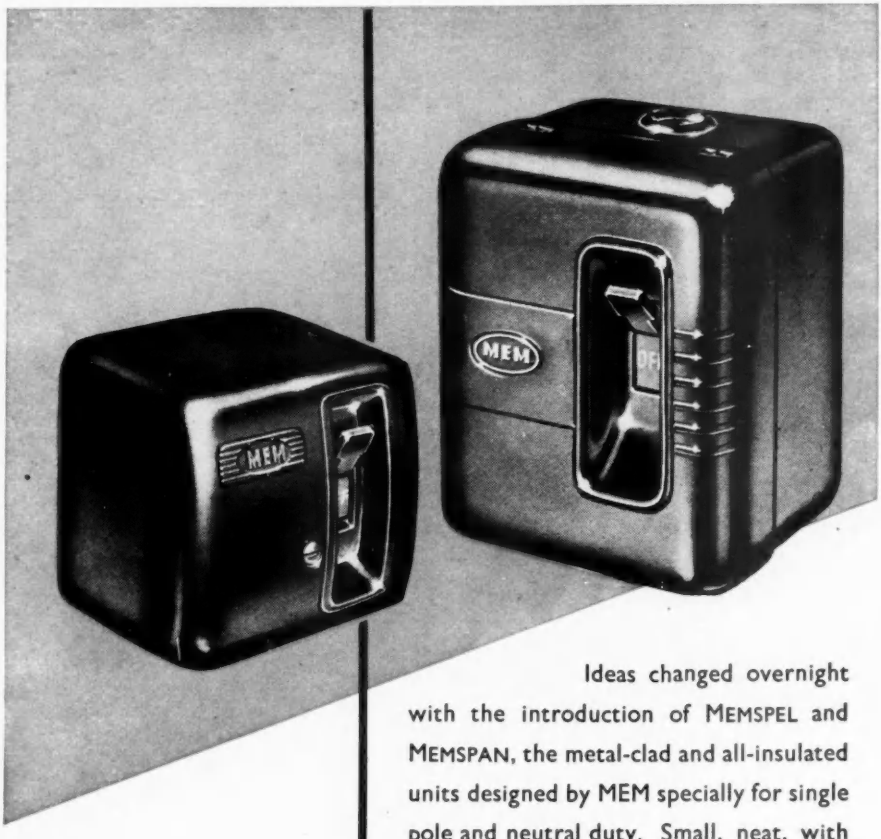

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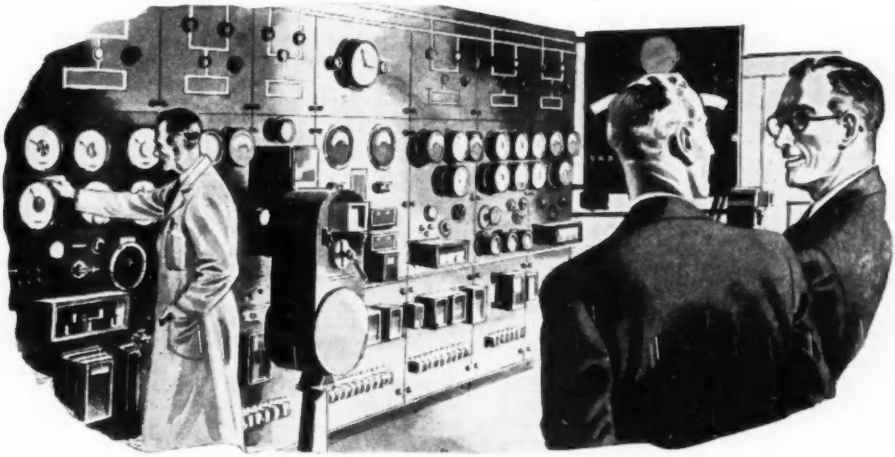

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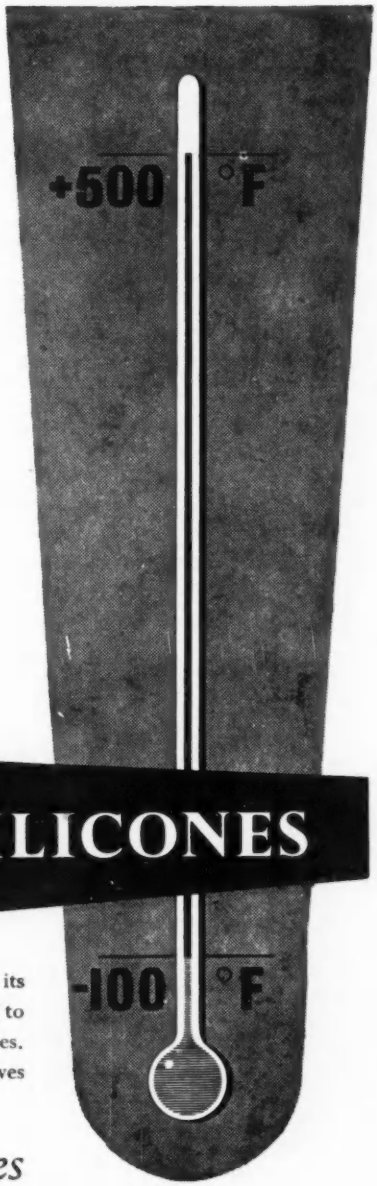

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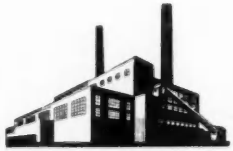

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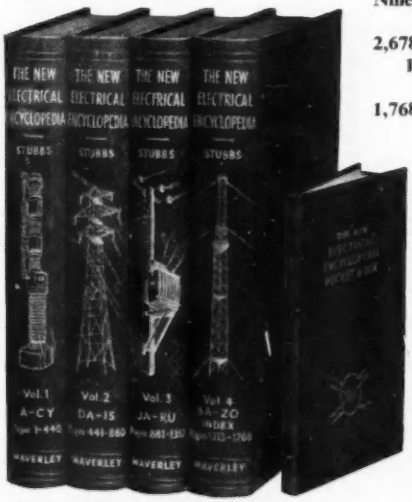

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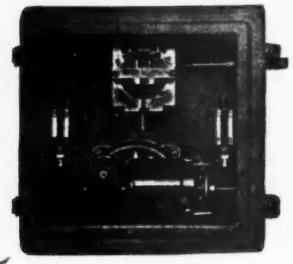

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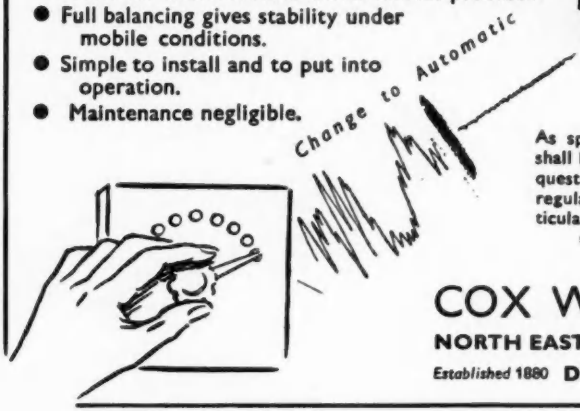

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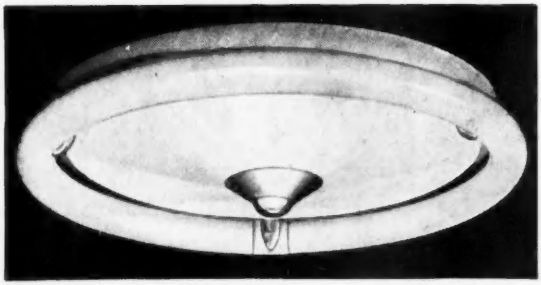

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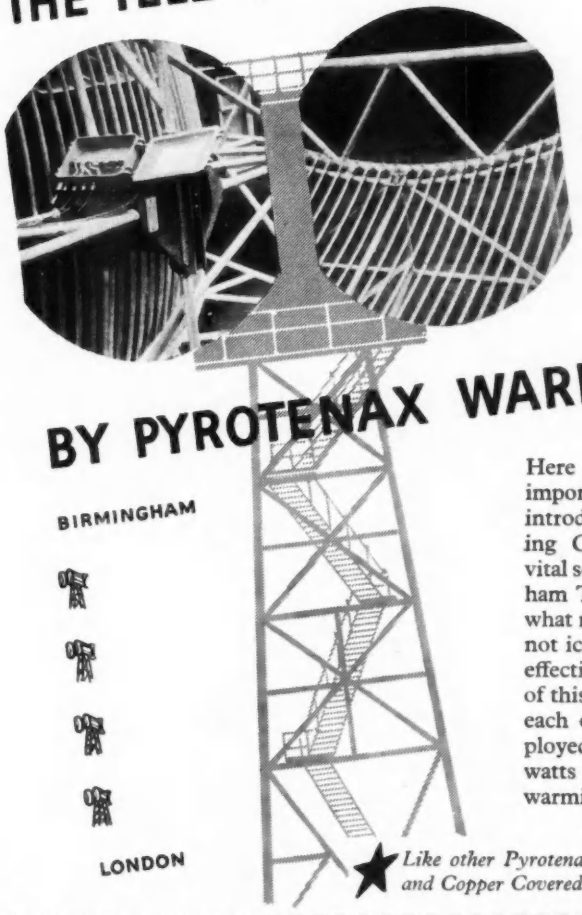

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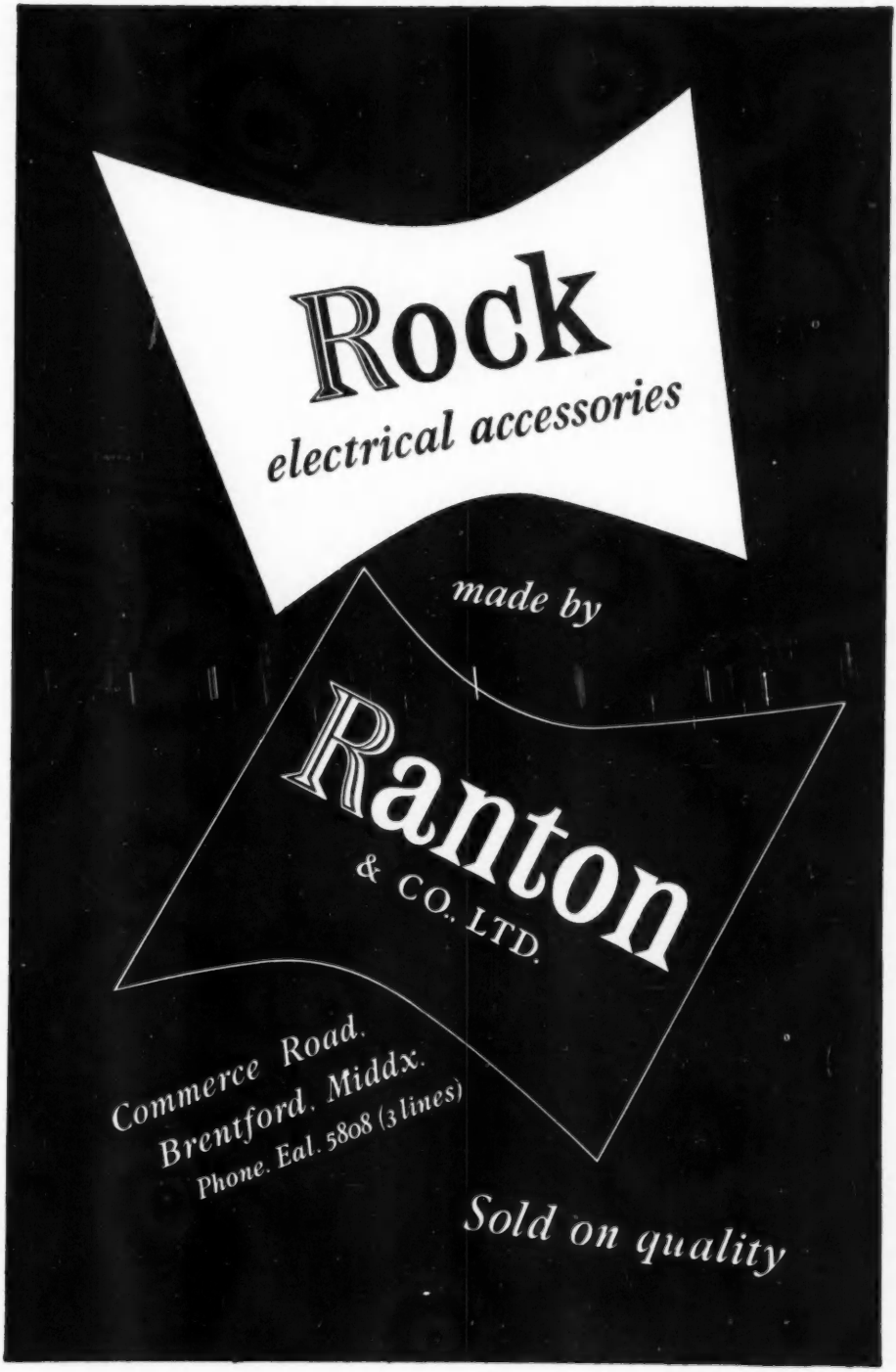
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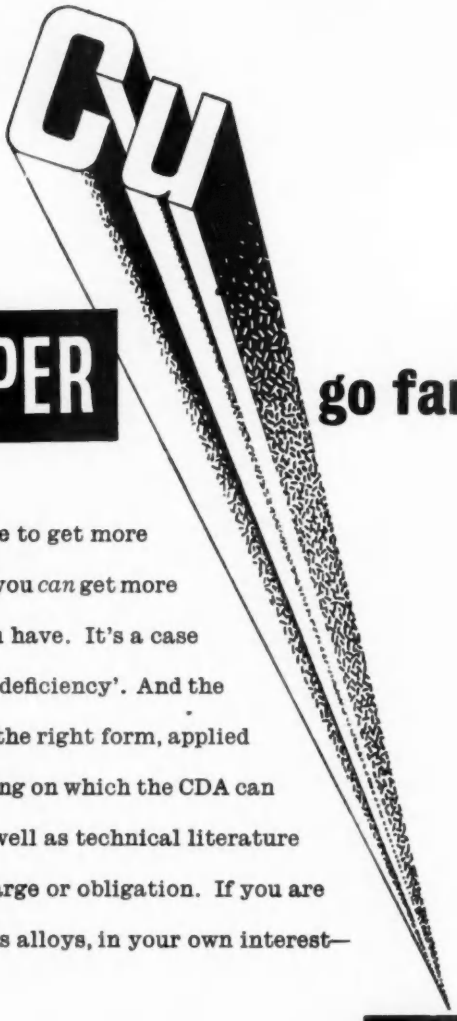

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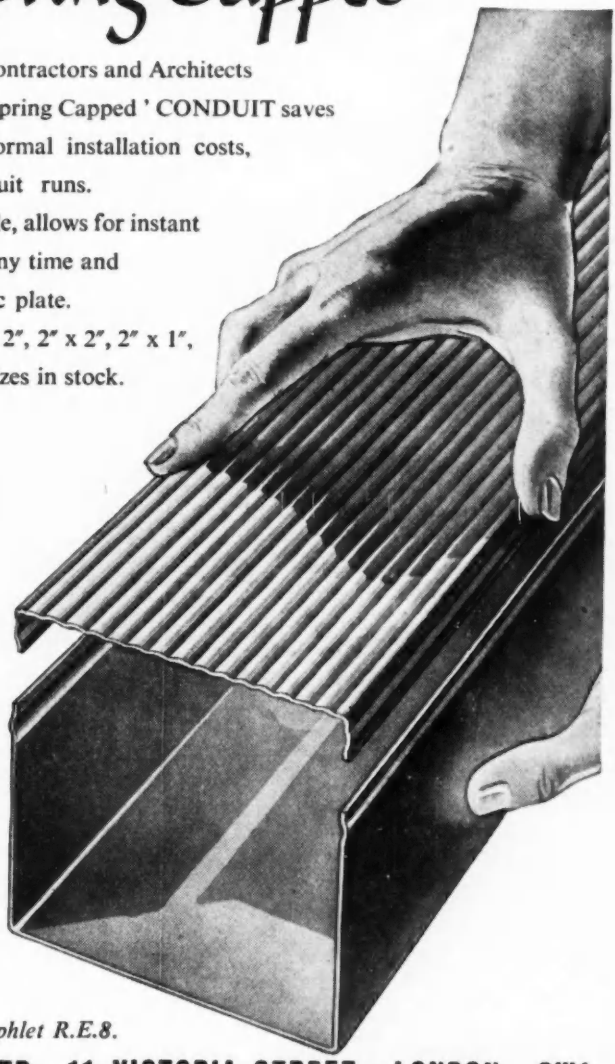

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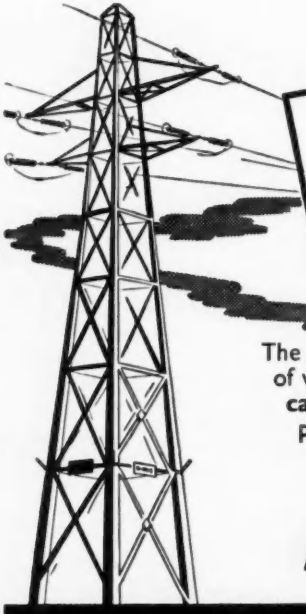

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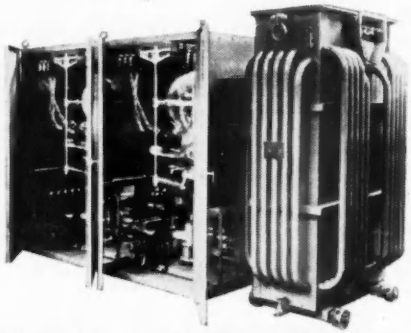

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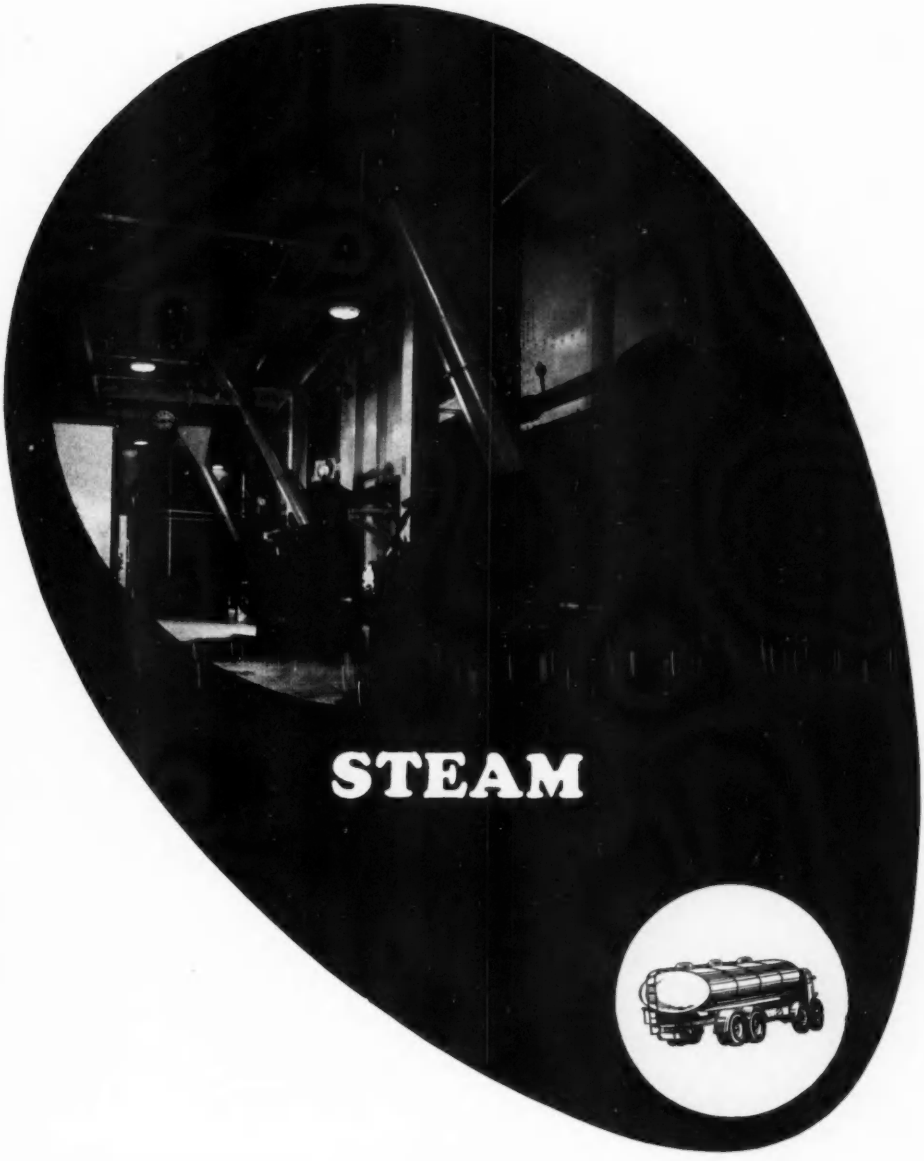

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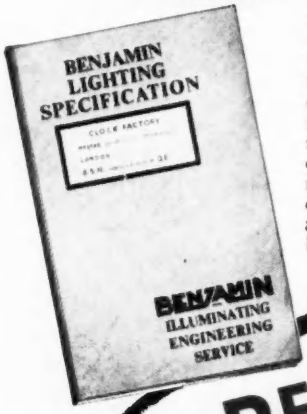

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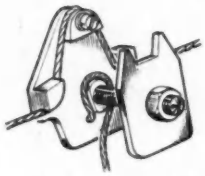
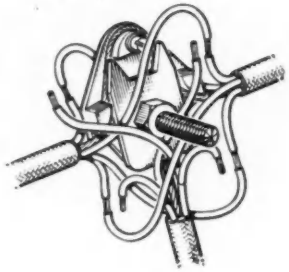


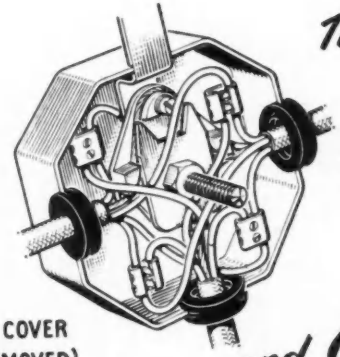
That's held in the clamp



Between the conductors (no cutting of cores)

That fit in the box

That's part of the system



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Triple-pole 15 A Manual Motor Starters

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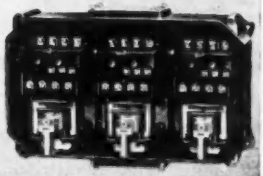

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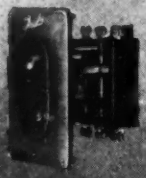

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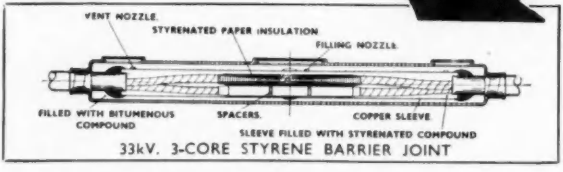
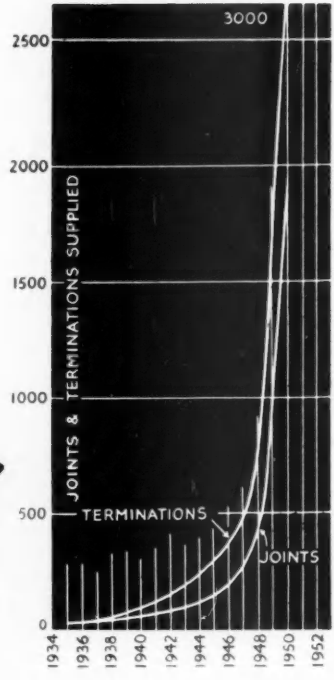


33kV. 3-CORE STYRENE BARRIER JOINT



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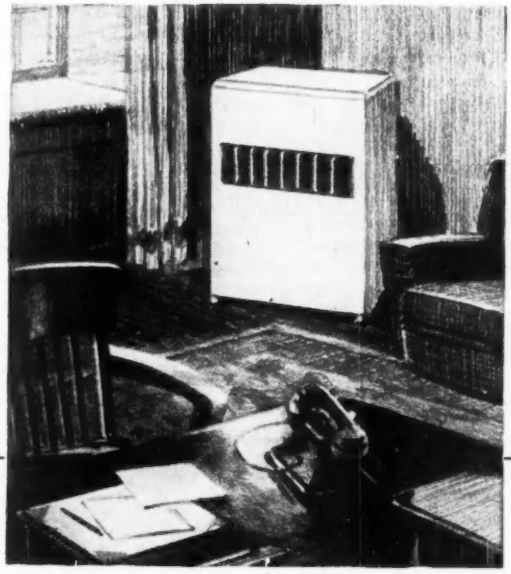

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FHP.8

C

RADIOVISOR

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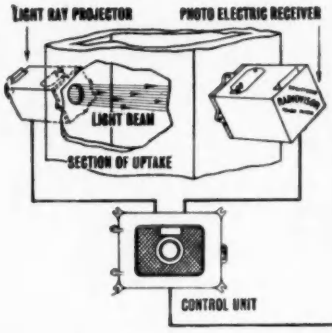
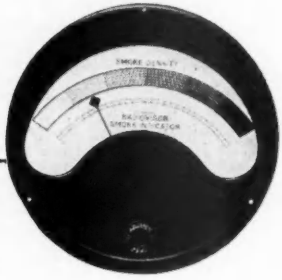


The Radiovisor Industrial Smoke Density Indicator is in extensive use in Power Stations and Industrial Power Houses to give a continuous record of the smoke passing through a flue or up-take. A ray of light is projected across the flue on to a Photo-Electric Cell. The intensity of light received by the latter, and consequently the photo-electric current, is governed by the smoke density. After amplification, the photo-electric current is indicated on a Ringleman Smoke Scale. Indicator Alarms and Recorders can also be fitted.

The units are designed for bolting direct to a stack or up-take, and plate-glass windows protect the optical components from direct contact with flue gases. Air jets keep the windows free from soot deposits.



Other Radiovisor Photo-Electric and Electronic Controls include: Flamestat Flame-Failure Control, Factory Lighting Control, Escalator and Lift Control, Counting Unit, Invisible Ray Burglar Alarm.

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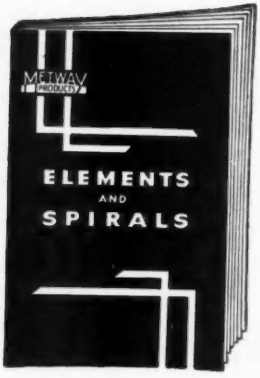

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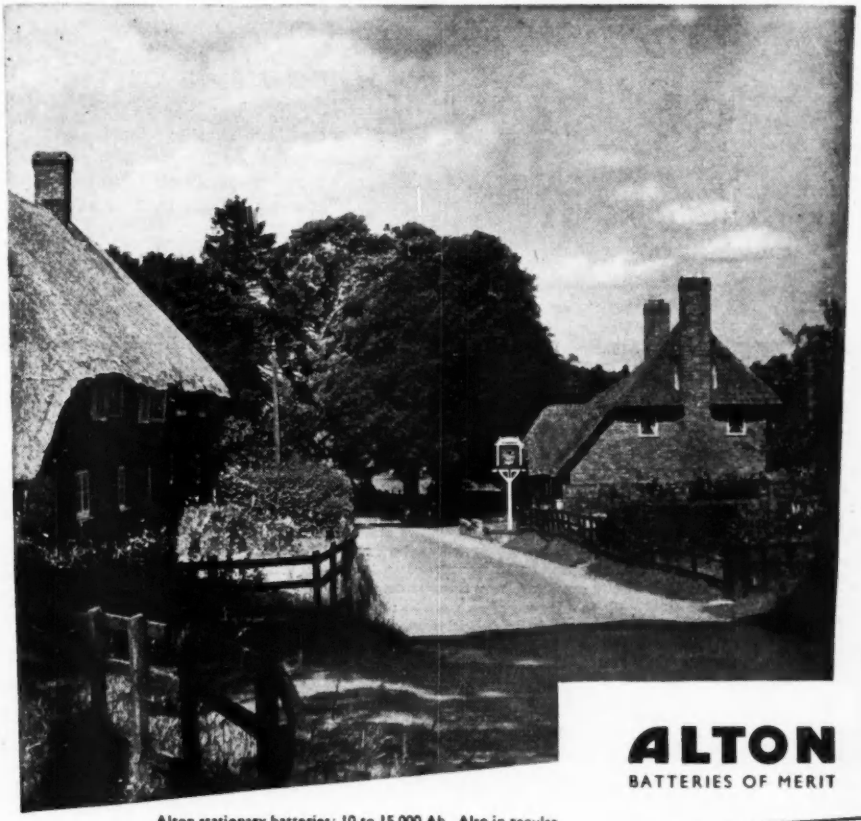

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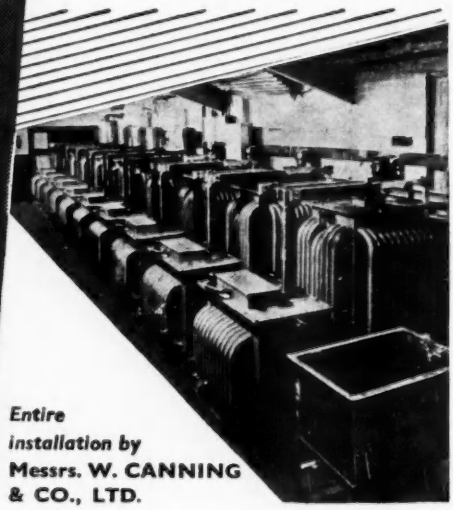

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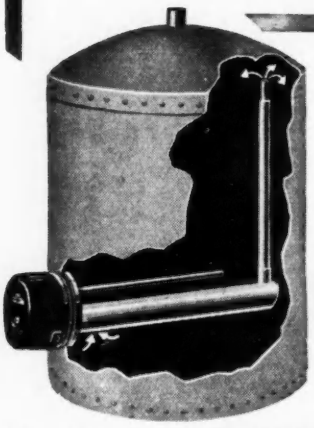

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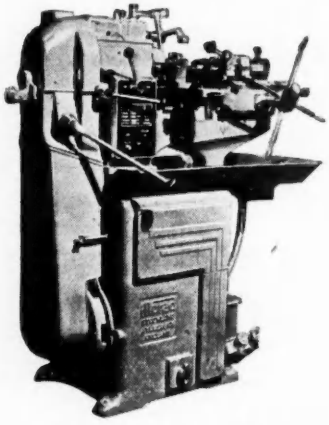

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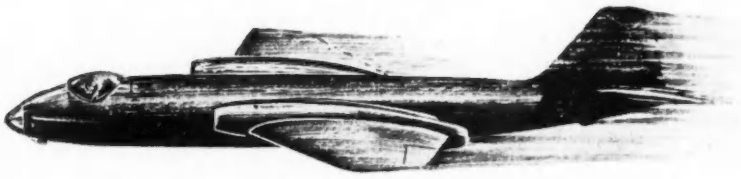

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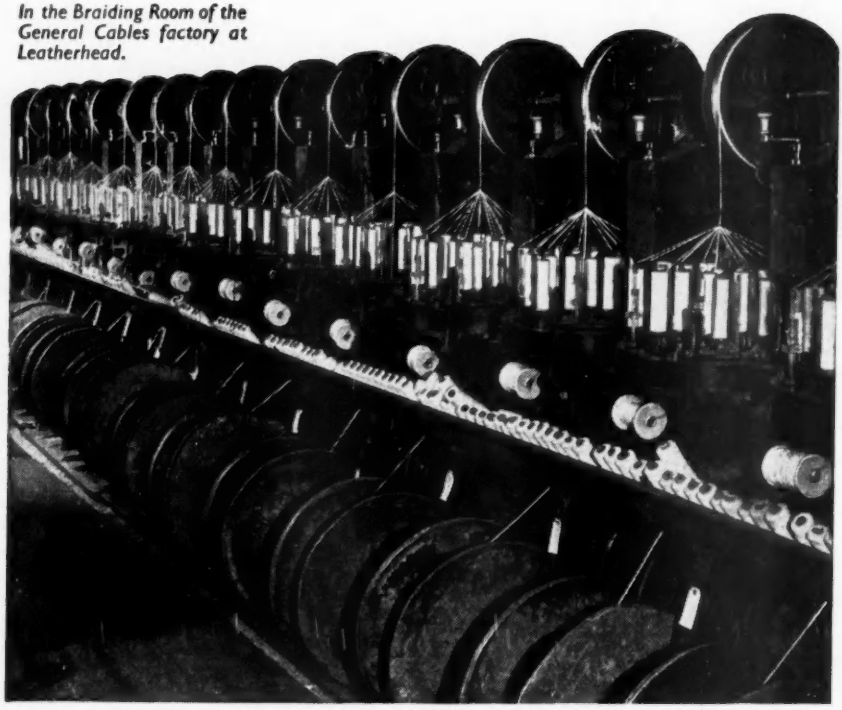

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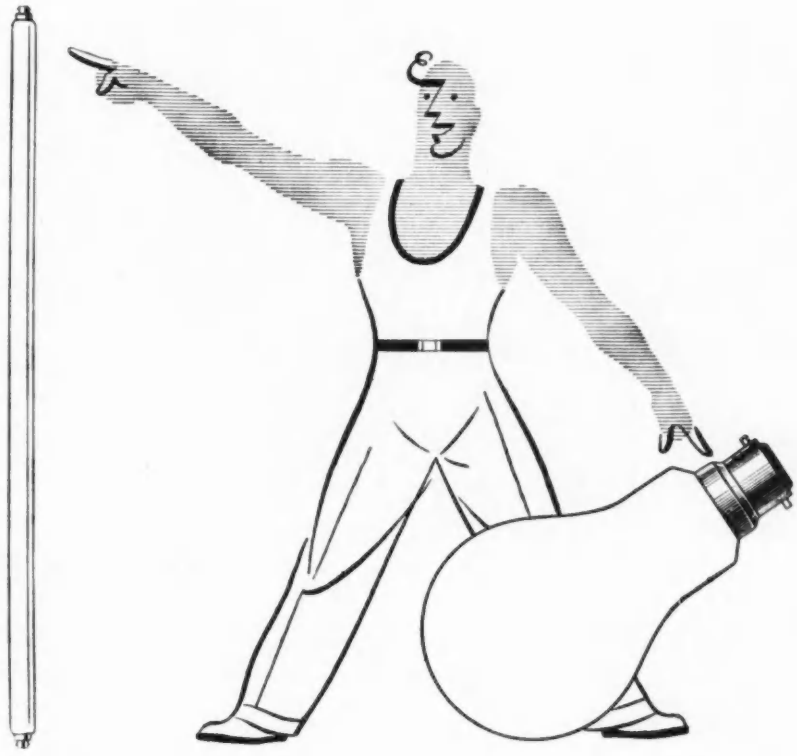

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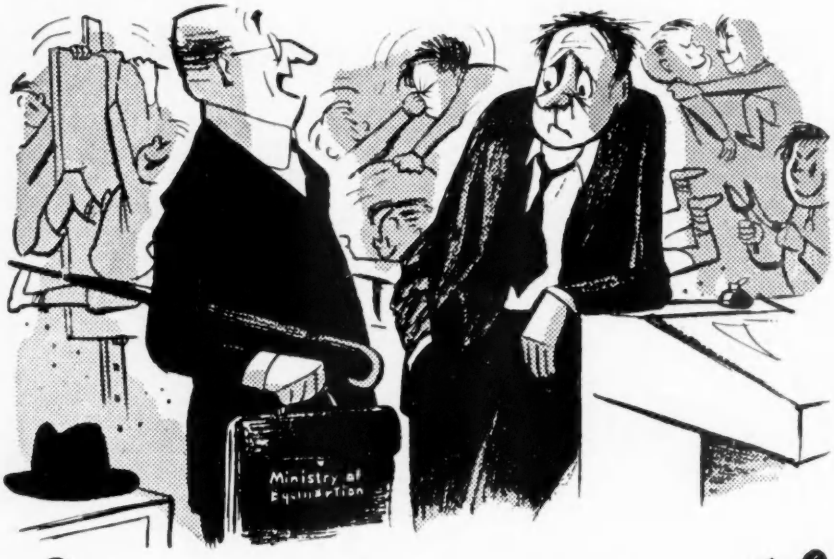

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It pays to make your lighting stronger:
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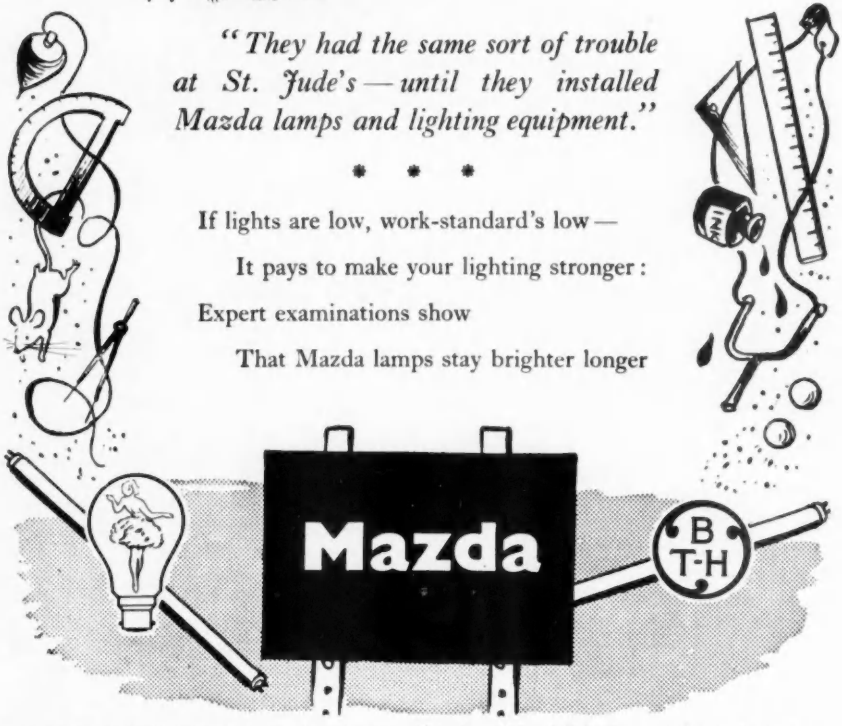

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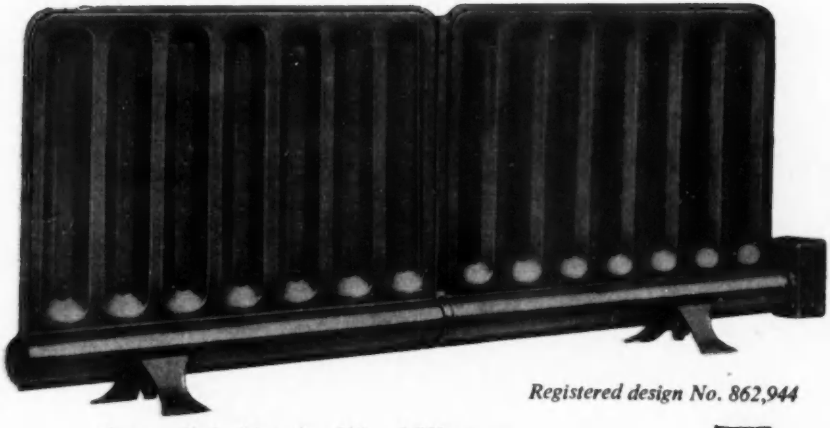

Registered design No. 862,944

Also supplied with rating 500 and 750 watt.
Dimensions: 28″ × 20″

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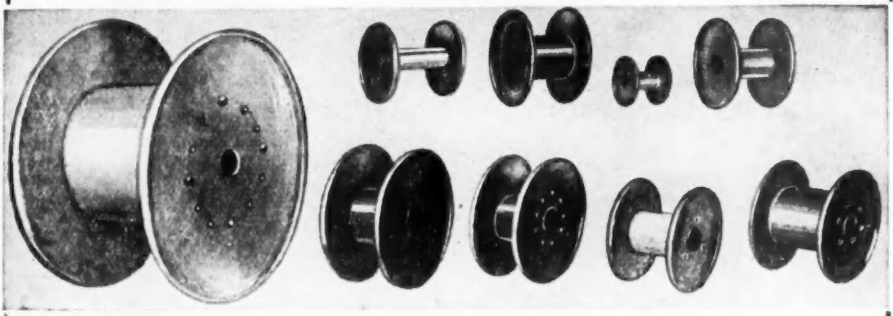

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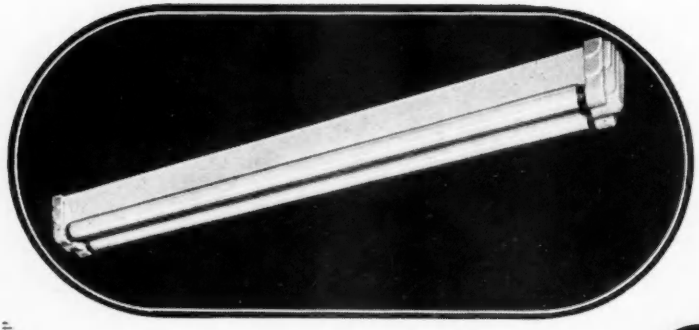

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Ashathene has been developed to provide a tough, yet flexible, cable which utilises the most modern materials in the best possible way.
The conductors are covered in polythene which provides a high dielectric and high voltage insulation unaffected by water, oil, petrol or aromatic solvents. The sheathing in PVC ensures a tough covering requiring no further protection which is unaffected by atmospheric oxidisation or sunlight.
Ashathene is manufactured in all standard sizes and is also available in SWA and DWA classes.

HIGH DIELECTRIC — Polythene insulated cores have a measured insulation resistance more than 100 times that of similar rubber insulated material.

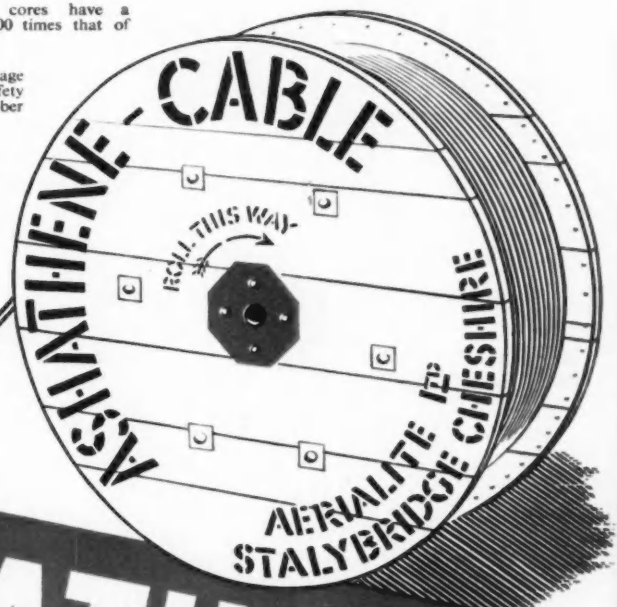
HIGH VOLTAGE INSULATION — High voltage tests on Ashathene Cable show a factor of safety 1.6 times greater than the equivalent rubber insulation on the same size of cable.

FIRE RESISTING QUALITIES — The P.V.C. used on the sheathing of Ashathene will not support or spread a flame and, unlike rubber, is self extinguishing when the flame is removed.

MECHANICAL QUALITIES — Ashathene is a tough flexible cable which is unaffected by climatic conditions. It is manufactured to give long and trouble free service.
Compared with rubber, polythene insulated conductors will withstand over twice the mechanical pressure without an electrical failure occurring.

PROOF TEST—All core used in Ashathene cable is subjected to a proof test at 3,500 volts 50 c/s for 15 minutes; this is more than twice the voltage required by the provisions of B.S.7 : 1946 for rubber insulated cable and B.S.1557 : 1949 for thermoplastic insulation.

Please send for the technical leaflet TL/1001 which deals with Ashathene cables.



ASHATHENE

THERMOPLASTIC CABLE

the Age...

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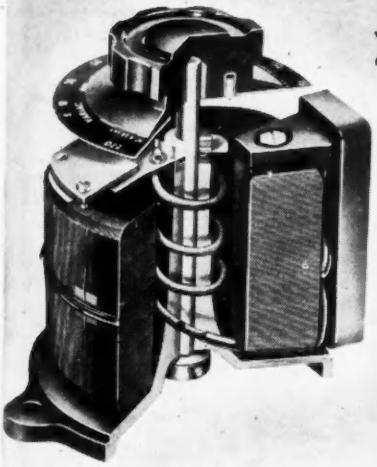

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'VARIAC'*

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*Registered Trademark.

SPECIFICATIONS

SERIES "50" Variacs

Type	Load Rating	Input Voltage	Current		Output Voltage	No-Load Loss	Net Price £ s. d.*
			Rated	Maximum			
50-A	5 kva.	115 v.	40 a.	45 a.	0-135 v.	65 watts	44 18 6
50-B	7 kva.	230/115 v.	20 a.	31 a.	0-270 v.	90 watts	44 18 6

SERIES "100" Variacs

Type	Load Rating	Input Voltage	Current		Output Voltage	No-Load Loss	Net Price* £ s. d.
			Rated	Maximum			
100-K	2000 va.	115	15 a.	17.5 a.	0-115	20 watts	17 17 0
100-KM	2000 va.	115	15 a.	17.5 a.	0-115	20 watts	18 12 0
100-L	2000 va.	230/115	8 a.	9 a.	0-230	25 watts	17 17 0
100-LM	2000 va.	230/115	8 a.	9 a.	0-230	25 watts	18 12 0
100-Q	2000 va.	115	15 a.	17.5 a.	0-135	20 watts	18 9 0
100-QM	2000 va.	115	15 a.	17.5 a.	0-135	20 watts	19 4 0
100-R	2000 va.	230/115	8 a.	9 a.	0-270	30 watts	18 9 0
100-RM	2000 va.	230/115	8 a.	9 a.	0-270	30 watts	19 4 0
100-LH	1200 va.	480/240	2 a.	2.5 a.	0-480	25 watts	21 15 0
500-L ⊙	1450 va.	180	8 a.	9 a.	0-180	25 watts	17 17 0
2000-K †	1000 va.	125	8 a.	9 a.	0-125	25 watts	17 17 0

⊙ For 500 cycles. † For 2,000 cycle service.

SERIES "200" Variacs

Type	Load Rating	Input Voltage	Current		Output Voltage	No-Load Loss	Net Price £ s. d.*
			Rated	Maximum			
200-CM } 200-CU }	860 va.	115 v.	5 a.	7.5 a.	0-135 v.	13 watts	7 17 6 / 6 15 0
200-CMH } 200-CUH }	540 va.	230 v. 115 v.	2 a. 0.5 a.	2.5 a. 2.5 a.	0-270 v. 0-270 v.	20 watts 20 watts	9 13 0 / 8 5 9

* All 'VARIAC' prices plus 20% as from 23rd Feb. 1952

Write for catalogue V549 which gives full details of 'VARIAC' transformers and suggestions for use, as well as data on other special patterns.

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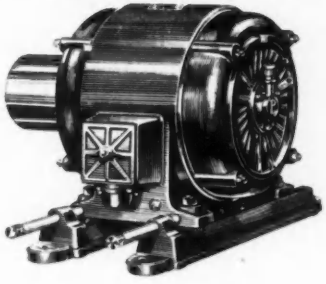

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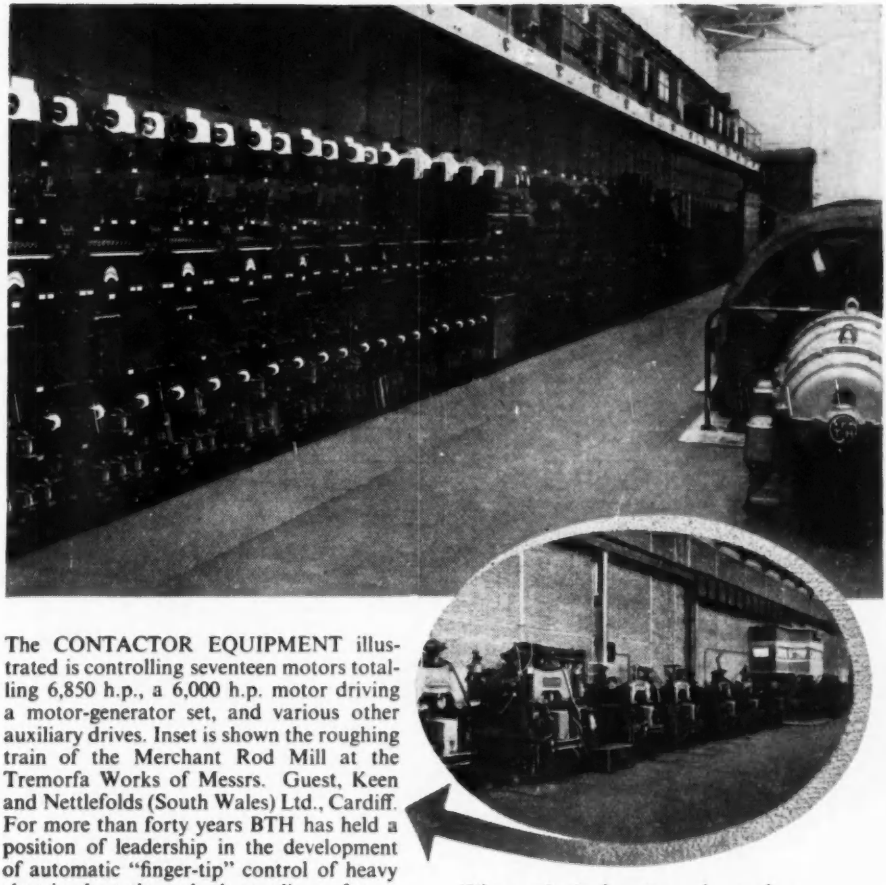

The CONTACTOR EQUIPMENT illustrated is controlling seventeen motors totalling 6,850 h.p., a 6,000 h.p. motor driving a motor-generator set, and various other auxiliary drives. Inset is shown the roughing train of the Merchant Rod Mill at the Tremorfa Works of Messrs. Guest, Keen and Nettlefolds (South Wales) Ltd., Cardiff. For more than forty years BTH has held a position of leadership in the development of automatic "finger-tip" control of heavy electric plant through the medium of contactors. These contactors, designed by experts, are proved by protracted "life tests" before going into service.

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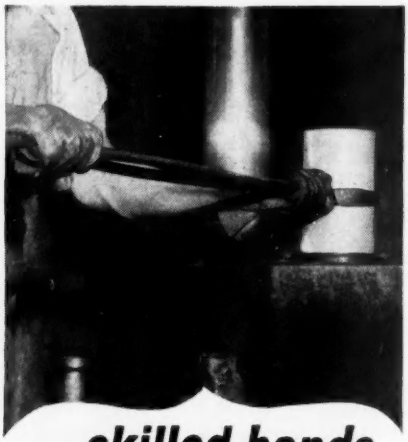

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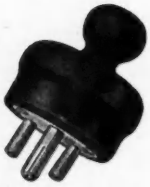

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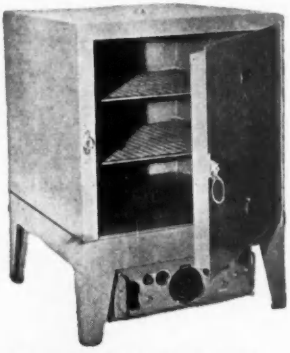

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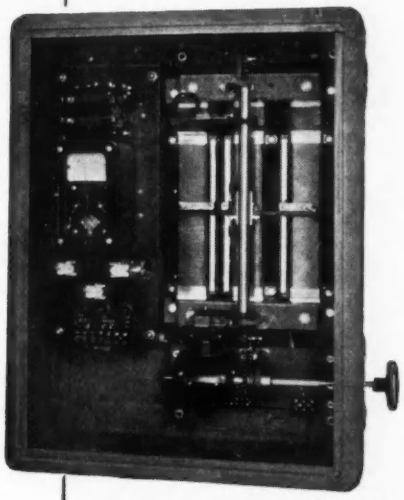
If your plant or process depends on an absolutely constant mains voltage, then "V.F."* (Voltage Fluctuation) may be costing you much more than you realise. Every ± variation results in loss of efficiency, and increases operating costs. That is why BERCO and BPT voltage control and regulating equipment plays an important part in well planned industries all over the world — keeping voltage under control!



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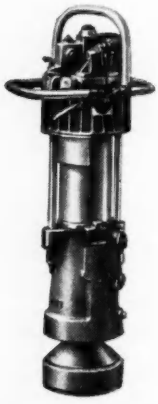

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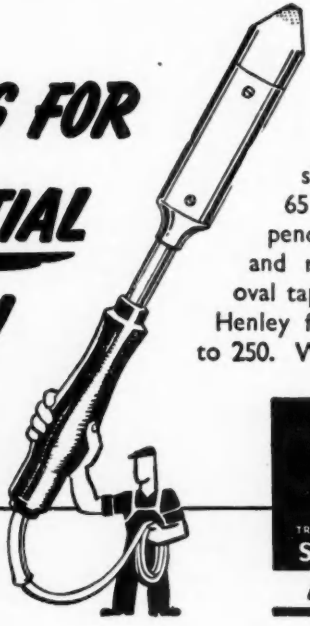

Use SOLONS for the jobs that matter — this modern precision tool makes soldering speedier, simpler and more reliable. 5 models: 65 watt with oval tapered and round pencil bit; 125 watt with oval tapered and round pencil bit; 240 watt with oval tapered bit; each with 6 feet 3-core Henley flexible. Voltage ranges from 100 to 250. Write for folder Y.10.

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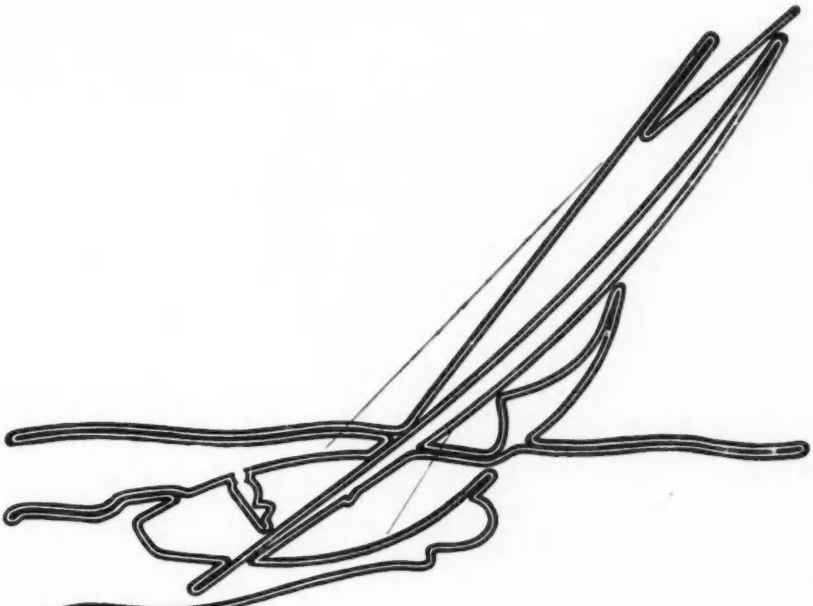

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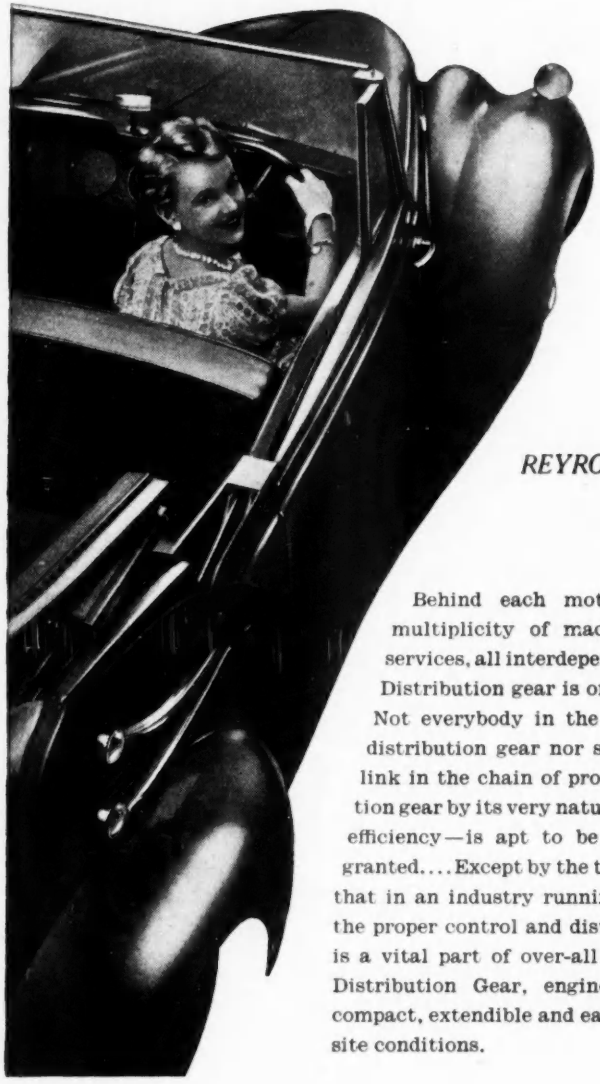

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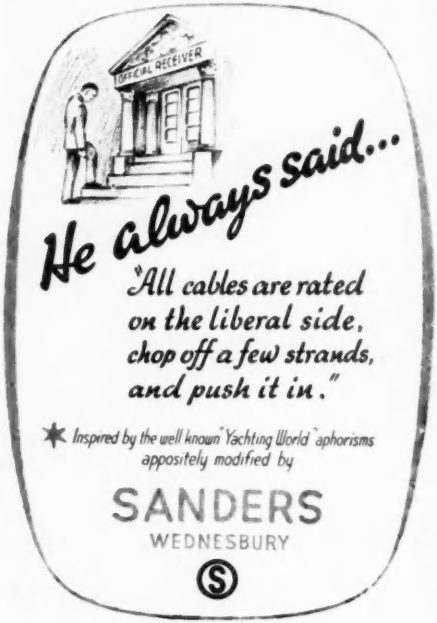

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"All cables are rated on the liberal side, chop off a few strands, and push it in."

✱ *Inspired by the well known "Yachting World" aphorisms appositely modified by*

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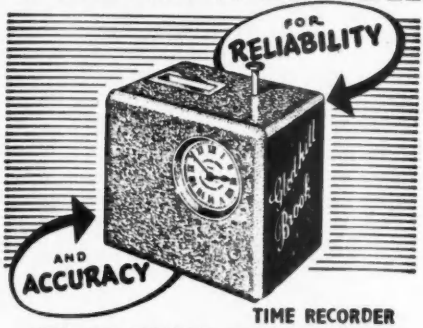

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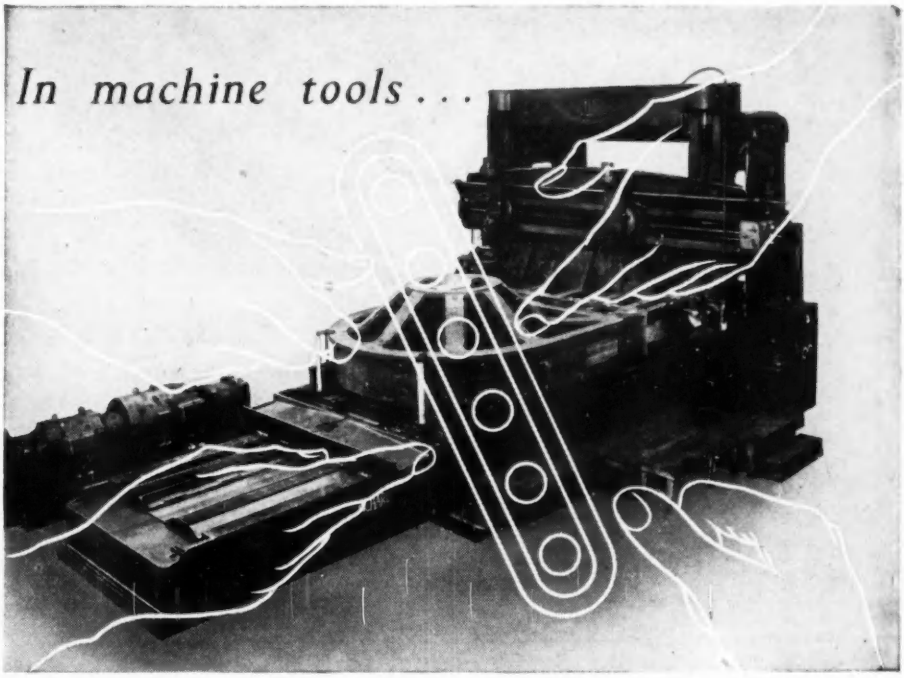

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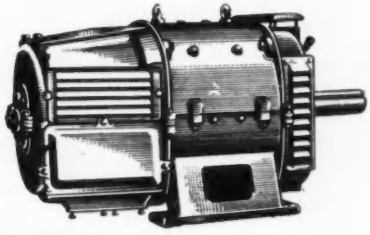

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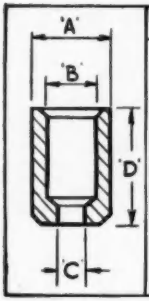

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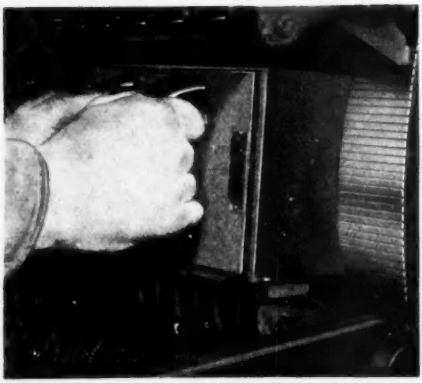

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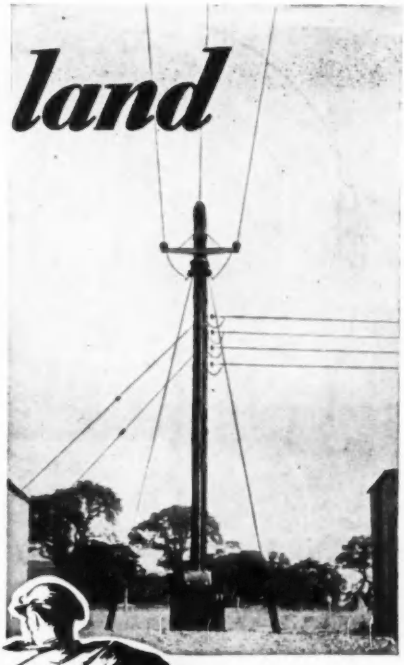

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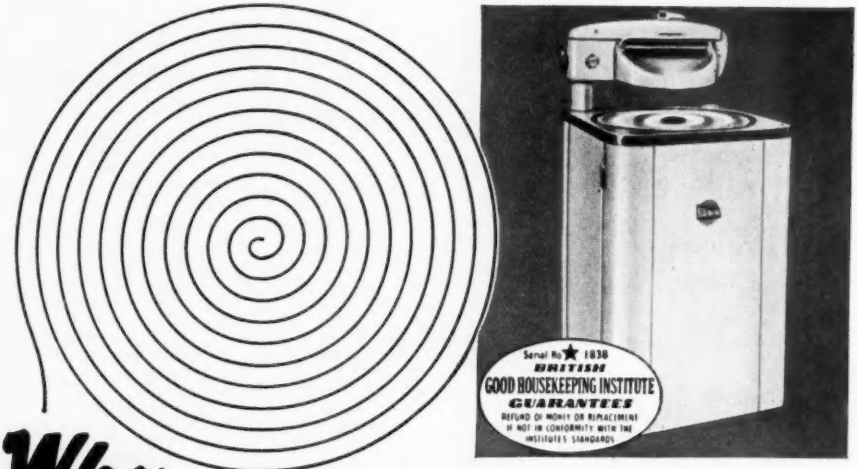

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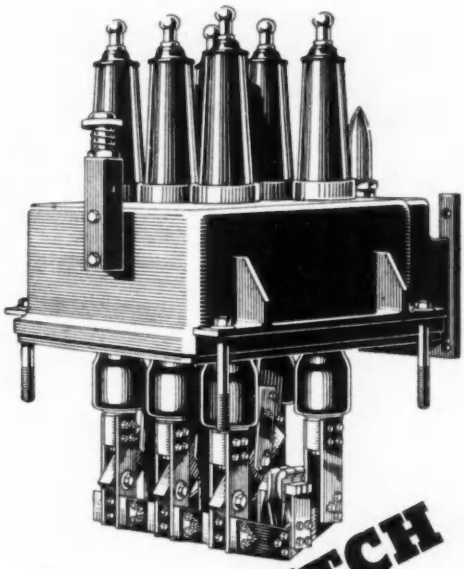

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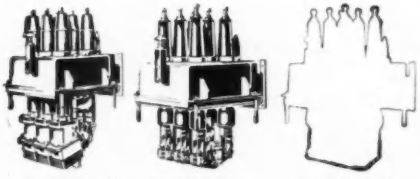

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ELECTRICAL TIMES

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Editorial

PRODUCTION CONTINUITY

PRODUCTIVITY, as economists and politicians continue to remind us, is still a subject of first importance for the well-being of the British nation. So it is not surprising that the funeral pyre suggested by the title "The Final Report" for the latest publication of the Anglo-American Council on Productivity turns out to be the setting for a phoenix-like rebirth. The review of the working of the bipartite council which the title promises merges readily into plans for the proposed British Council on Productivity, which is to carry on the work of the joint organisation on this side of the Atlantic. In its record of the past, the report leaves no doubt about the usefulness to the industries directly concerned of the visits that have been paid to America, but, as so often happens, the greatest benefit has been obtained indirectly. Public attention drawn to the activities of the Council has resulted in a greater awareness of the importance of productivity, and of the possibilities of increasing it. This creation of the right atmosphere is as important for success as the mutual impact of British and overseas practices. All will wish the new Council success in this and other aspects of the task which it inherits.

DISCHARGE IN GASES

FROM the magnificence of the lightning flash to the troublesome but unobtrusive sparking which occurs at the contacts of telecommunications relays, the whole subject of electric discharges is of direct interest to the electrical engineer. Each tends, naturally, to think mainly in terms of his own specialist field, with a passing interest in a few other applications that have attracted his attention. For such, the selection of papers on theories of discharges in gases which was presented on Monday at the British Association meeting in Belfast offered a useful overall picture of the underlying mechanisms of the various phenomena concerned and of the relative completeness of knowledge regarding each aspect. Particularly interesting in this respect is the work proceeding at the University of Wales, under the direction of Professor Llewellyn Jones. Attempts there to evolve a general theory for the cathode mechanisms associated with the widely varying types of discharge appear to be meeting with considerable success. This will be specially welcomed by those engineers who, faced with the need to read up the physics of this branch of their subject, have found that there is a collection of apparently unconnected theories to account for observations having, at first sight, much in common.

ELECTRONIC RELIABILITY

LAST week's symposium organised by the Scientific Instrument Manufacturers' Association brought a further contribution to the continuing debate on industry's attitude to electronic apparatus as part of production equipment. As always, discussion centred on two salient difficulties: how reliable is the valve, and is it advisable to carry on the maintenance staff of the firm using electronic equipment an electrician with experience of such matters? Speakers in the Association's helpfully named Users' Forum felt able to state more confidently than in past years that the traditional attitude towards the valve as an essentially unreliable and short-life circuit element is now outmoded. For industrial service, better performance can be expected, and experience was quoted in support of this contention. They could not help so directly, however, with the difficult question of recruiting men with the minimum ability to distinguish the serious fault from the slight maladjustment, though a gradual approach through electro-mechanical control was suggested as helpful. Perhaps the answer lies in the large number of men who are returning to industry after performing their

National Service training, with enough experience with electronic equipment to fulfil this requirement.

HEAT FIGHTS FIRE

A FEW weeks back there was noted in these columns a satisfying drop in the number of fires in buildings which fire brigade officers attributed to faults in electrical apparatus. At the Radio Show which closed last week, one of the most promising methods of consolidating this improvement and making domestic equipment safer still was exhibited. This is the use of bimetal buttons suitably positioned at points of maximum risk in electrical circuits to interrupt the current if temperatures approach those at which a conflagration may occur. This is a method of protection which authorities on safety have been advocating for some years. Its properties certainly approach the ideal for protective gear, for it combines detection of the direct cause of danger, temperature, with automatic action to interrupt its root source, the flow of current; in addition, it is relatively inexpensive, permitting installation on an extensive scale. Successful application to radio and television sets need only be a beginning in the domestic field. As Mr. Swann demonstrated at several I.E.E. meetings last session, protection of this type can be particularly effective when apparatus is driven by f.h.p. motors. The principles concerned are by no means new, but they merit more attention in view of the increasing importance of protecting the consumer against trouble from his electrical equipment.

JOB FOR SOMEONE

THIS is the time of the year when manufacturers of electric lamps are bringing into operation those schemes for publicising their products which do so much to brighten the hoardings of the towns and the windows of electrical retailers. Across the Atlantic, though autumn becomes fall, the annual emphasis on home and office lighting is appearing to a similar degree. But there similarity ceases, for in the United States it is the electricity supply companies rather than the lamp firms which supply the major effort, in vigorous campaigns aimed at persuading consumers to use ever higher standards of illumination. This approach seems to find a ready acceptance in the American mind, for a recent survey of the results that are obtained suggests an annual consumption of 590 units per residential consumer as attributable to the lighting load, a total well in advance of the 175 units/year estimated as the British average by an investigator a few years ago. The achievement of such a demand indicates that there is a big reward awaiting whatever organisation in this country succeeds in inspiring a like interest in brighter homes.

DEATH RAY

EVEN before radio became a reality, the idea of a "death ray" as a wartime weapon was the established plaything of scientifically minded writers of the lighter brand of fiction. In more recent years, the schemes advanced by their successors have seemed ever more plausible, though somehow they have never achieved full realisation. There is news this week, however, of practical use of the idea at last: but in a war against infection, with bacteria as the enemy rather than men. The potency of high-speed electrons and gamma rays as a means of killing moulds, yeasts and bacterial spores has been demonstrated, though the basic principle seems to be that the smaller the organism the more difficult it is to exterminate. Much of the work in this field has been the result of an urgent need to find applications for the radio-active by-products of the production of plutonium and other materials for the atomic energy programme, but electro-magnetic machines are playing a prominent part, particularly promising results having been obtained from apparatus of the electron accelerator type. The aim of the techniques being developed, as explained elsewhere in this issue, is the development of economical methods of sterilising foodstuffs and preparing pharmaceutical products that are safer in use. So the realisation of the novelists' imagination is proving far more peaceful than they can have expected.

Meteor

CURRENT TRANSFORMERS under Overload Conditions

Simplified methods of calculating operating characteristics described

By A. A. HALACSY, D.Sc.(Eng.), A.M.I.E.E.

PROTECTIVE current transformers usually have to perform their functions under overload conditions. They must not only be accurate, but must also provide the volt-amperes, sufficient for the proper operation of the relays and overload coils acting on the respective circuit breakers. The proper operation of discriminative protective devices depends on the proper VA-output of the c.t.

A current I_1 flowing through the N_1 primary turns of a c.t. creates a magnetising force H_1 in the core. A part H_0 of that H_1 magnetises the core, whereas the rest (H_1-H_0) is balanced by the magnetising force H_2 due to the current I_2 flowing in the N_2 secondary turns.

B is to be read against the magnetising component H_0, from the magnetisation curve of the material used for the core. We cannot, however, calculate the value of H_0 directly. We can calculate the value of H_1 only. It is, by definition, accumulating all the constants into a single figure

$$H_1 = 0{\cdot}695\ I_1N_1/l \quad \ldots\ldots(1)$$

$$\text{If } I_1 = I_{1FL}.\ p \quad \ldots\ldots(2)$$

Combining equ. (1) and (2)

$$H_1 = 0{\cdot}695\ I_{1FL}N_1.\ p/l \quad \ldots\ldots(3)$$

The calculation of H_2 and H_0 is not so simple. Neither of those can be worked out by direct calculation. However, it is found that the ratio B/H_2 has a constant value in the same c.t. and is for a 50 c/s sine wave

$$B/H_2 = 114\ Z_{2B}l/N_2^2A = \tan\Theta \quad \ldots\ldots(4)$$

where $Z_{2B} = \sqrt{(R_2+R_B)^2 + (X_2+X_B)^2}$ ....(5)

(See Appendix for the details.)

Equation (4) enables us to read the values of H_2 and H_0 from the mag. curve as shown in Fig. 1, and after the numerical value of $\tan\Theta = B/H_2$ have been worked out for the c.t. in question. A straight line has to be drawn at an angle Θ from the H_1 point on the H axis of the curve. Its intersection with the magnetisation curve gives B and H_0 and

$$H_2 = H_1 - H_0 \quad \ldots\ldots(6)$$

Ratio Error

The ratio error can be worked out easily once H_1 and H_2 is known. The ratio error is by definition (B.S. 81).

$$\varepsilon = 100\ (K_n - K)/K \quad \ldots\ldots(7)$$

where $K_n = I_{1n}/I_{2n}$ is the nominal ratio of the c.t., and $K = I_1/I_2$ is the actual ratio of the

LIST OF SYMBOLS

I = current, r.m.s. amps	l = mean length of the magnetic path in the iron core, inches	ε = ratio error, %	
E = voltage, r.m.s. volts			
P = voltamperes		*Subscripts:*	
R = resistance, ohms	A = cross-section of the iron core, sq. in.	0 = magnetising	
X = reactance, ohms		1 = primary	
Z = impedance, ohms	V = volume of the iron core, cu. in.	2 = secondary	
B = magnetic induction, peak, Kilogauss		n = nominal	
	p = load in multiples of the full load (full load = 1)	T = turn	
H = magnetising force, peak, Oersted		FL = full load	
N = turn number	K = ratio	B = burden	

It is stressed that r.m.s. values are taken for the currents and voltages, whereas peak values for H and B are usually given in magnetisation curves issued by manufacturers.

currents. That latter K can be rewritten as follows:

$$K = I_1/I_2 = I_1N_1N_2/I_2N_2N_1 = K_T H_1/H_2 \ldots . (8)$$

where $K_T = N_2/N_1$ is the turn ratio of the c.t.

Combining equ. (7) and (8)

$$\varepsilon = 100 (K_n H_2 - K_T H_1)/K_T H_1 \ldots . (9)$$

K_n and K_T are constants of the c.t., while H_1 and H_2 can be worked out for each load as shown above. ε results from equ. (9) for each value of I_1.

VA-Output

The VA-output of the secondary of a c.t. is

$$P_2 = E_2 I_2 \ldots . (10)$$

E_2 can be expressed from the general transformation equation and for 50 c/s sine-wave voltage as

$$E_2 = B.A.N_2/80 \ldots . (11)$$

Similarly I_2 can be expressed using the definition of the magnetising force as follows:

$$I_2 = 1{\cdot}44 H_2 l/N_2 \ldots . (12)$$

The volume of the core is $V = A.l \ldots . (13)$

Combining equ. (10), (11), (12) and (13)

$$P_2 = 0{\cdot}0182 B H_2 V \ldots . (14)$$

B and H_2 have already been worked out above and so P_2 can be calculated using equation (14).

All the above calculation relates to 50 c/s a.c. In case of any other frequency f, the constant 114 in equation (4) must be multiplied by 50/f, whereas the right-hand sides of the equations (11) and (14) must be multiplied by f/50.

Practical Example

A 600/5 amp ring-type c.t. has to be checked. The primary has $N_1 = 1$ turn (being a ring-type c.t.), the secondary $N_2 = 118$, resulting in $K_n = 600/5 = 120$, and $K_T = 118/1 = 118$. There are $I_1N_1 = 600$ ampere-turns present at $p = 1$, i.e. at full load. The core is built of Stalloy, the magnetisation curve of which is shown in Fig. 1. The cross sectional area of that core is $A = 2{\cdot}25$ sq in., its mean length $l = 20{\cdot}25$ in., its volume $V = 2{\cdot}25 \times 20{\cdot}25 = 45{\cdot}5$ cu in.

The nominal output (at full load) of the c.t. is 15 VA, giving an impedance of the burden $Z_B = 15/I_2^2 = 15/5^2 = 0{\cdot}6$ ohms.

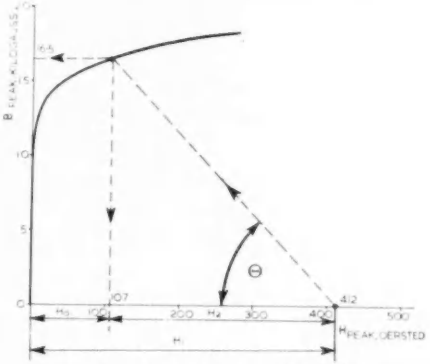


Fig. 1. Magnetisation curve for Stalloy core

The impedance of the c.t. itself has to be added to that impedance of the burden and the result is $Z_{2B} = 0{\cdot}72$ ohms.

From equation (4)

$$\tan \Theta = B/H_2 = 114 \times 0{\cdot}72 \times 20{\cdot}25/118^2 \times 2{\cdot}25 = 0{\cdot}053.$$

From equation (9)

$$\varepsilon = 100 (120 H_2 - 118 H_1)/118 H_1 \ldots . (15)$$

where $H_1 = (0{\cdot}695/20{\cdot}25) I_1N_1 = 0{\cdot}0343 I_1N_1$ from equation (1).

From equation (14)

$$P_2 = 0{\cdot}0182 \times 45{\cdot}5 B H_2 = 0{\cdot}825 B H_2 \ldots . (16)$$

The rest of the calculation can be done in

TABLE I.—Details of Calculation to Determine C.T. Characteristics

Load	Calculated		Read from mag. curve		Calculated					
	$I_1FLN_1p =$	from equ. 3				a =	b =	from equ. 9 and 15. 100 b/a =	from equ. 14 and 16.	from equ. 18
p	I_1N_1	H_1	H_2	B	K_nH_2	K_TH_1	$K_nH_2 - K_TH_1$	ε	P_2	P_B
	RMS amp. turn.	Peak Oersted		Kilo-gauss				%	VA	VA
1 = FL	600	20·6	20·3	1·1	2,440	2,433	+ 7	+0·288	18·4	18·4
5	3,000	103	102	5·5	12,250	12,030	+220	+1·88	461	460
10	6,000	206	203	10·75	24,400	24,330	+ 70	+0·288	1,800	1,840
20	12,000	412	305	16·5	36,600	48,600	−12,000	−24·7	4,150	7,350
30	18,000	618	338	18·3	40,550	73,000	−32,450	−44·4	5,070	16,600

a tabular form (Table I) and taking the readings from the mag. curve as explained above. The results are shown graphically in Fig. 2.

Consider now an overload protective device operated by that c.t. Obviously a current in direct ratio to the primary-current should be supplied by the c.t. to that device and in order to ensure its proper operation. In other words the device requires a current $I_B = p.I_{B\,FL}$. That means the overload protective device "requires"

$$P_B = I_B^2 Z_B = I_B^2 p^2 Z_B \text{ volt-amperes} \ldots (17)$$

Z_B is the impedance of that device and it is either known from data obtainable from the manufacturer or can be calculated or measured at various load-conditions. Supposing a simple case where Z_B keeps its value throughout the overload-range considered, we have

$$P_B/P_{B\,FL} = I_B^2/I_B^2{}_{FL} = p^2$$

$$P_B = p^2 P_{B\,FL} \ldots\ldots\ldots\ldots\ldots\ldots (18)$$

Those P_B-s are calculated in the last column

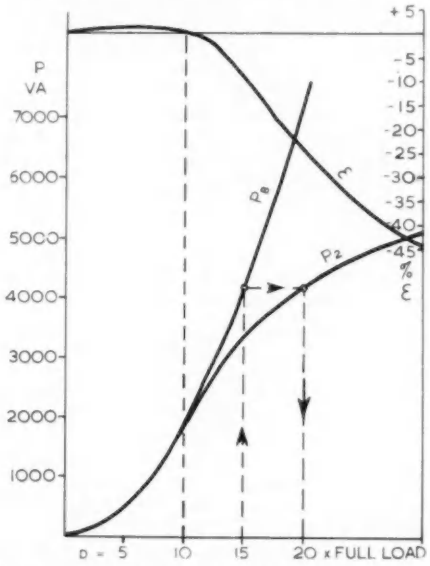


Fig. 2.—Graphical representation of current transformer characteristics as calculated in Table I

of the table. Their curve is included into Fig. 2.

Obviously the overload protective device will perform its function properly as long as P_2 keeps close enough to P_B. Fig. 2 shows that this happens up to about ten times full load in our example.

At higher loads P_2 is lagging more and more below P_B and the relay "feels" a load less than the one really present (e.g. Fig. 2 shows that 4,160 VA are required to let the relay "feel" an overload = 15 × full load). However, the c.t. will supply that 4,160 VA at an overload = 20 × (full load) only. That means the c.t. is "cheating" the relay and the overload-protection will not function properly.

This "cheating" sets in from the region where the curves of P_2 and P_B begin to depart strongly from each other. That happens where the curve of the ratio error ε bends heavily down. The ratio error of a c.t. is kept usually somewhat positive in the range below full load and changes its sign somewhere around the overload up to which the combination of the c.t. and relay can be used properly.

Such a behaviour of a system combined of a c.t. and an overload protective device necessitates the requirements raised from the part of the relay-manufacturers and limiting the magnetisation of c.t.s under overload conditon.

Appendix

The general transformer equation is (1 sq in. being $2{\cdot}54^2$ cm^2)

$$B = E_2\, 10^5/4 f_{form}\, f\, N_2\, s\, 2{\cdot}54^2\, A \quad \ldots (19)$$

$f_{form} = E_{RMS}/E_{mean} = 1{\cdot}11$ for sine waves. The frequency is taken as $f = 50$. The stacking factor of the iron core is chosen $s = 0{\cdot}88$. Substituting these figures the result is

$$B = 80\, E_2/AN_2 \ldots\ldots\ldots\ldots\ldots\ldots (20)$$

By definition the magnetising force in Oersteds equals $4\pi/10$ times the ampere turns per 1 centimetre length. Taking into account that 1 inch = 2·54 cm and that $I_{peak} = \sqrt{2}\, I_{RMS}$

$$H_2 = (4\pi/10)\sqrt{2}\, I_2 N_2/2{\cdot}54l = 0{\cdot}7\, I_2 N_2/l \ldots (21)$$

Combining equations (20) and (21)

$$B/H_2 = (80/0{\cdot}7)\,(E_2/I_2)\, l/N_2^2 A \ldots\ldots (22)$$

$E_2/I_2 = Z_{2B}$ impedance and so

$$B/H_2 = 114\, Z_{2B} l/N_2^2 A \quad \ldots\ldots\ldots\ldots (4)$$

Non-destructive Tests

ELECTRICAL methods of testing welds in various types of structure figure prominently in a new publication of the British Welding Research Association. Written as an introduction to the subject for inspectors and engineers unfamiliar with the advantages and limitations of the various methods available, this memorandum (T29, price 5s.) places emphasis on the scope of application of each method in the field of welding fabrication. Only relatively brief accounts are given of the different examination techniques.

Specifically electrical methods of test that are described comprise the induction, resistance and eddy current techniques, but for the electrical engineer and student there is further interest in the lengthy sections on radiographic methods of examination and acoustical methods.

The Ridley Committee Reports...

FORMATION OF ADVISORY PLANNING BOARD RECOMMENDED

CONTRARY to some expectations, the long-awaited report of the Committee on National Policy for the use of Fuel and Power Resources (The Ridley Committee) makes no violent attack on any particular fuel. Specifically it rejects the idea of a co-ordinating body with executive authority over the fuel and power industries, as unduly restrictive of their managerial responsibilities and in conflict with the responsibilities to Parliament of the Minister of Fuel and Power. The maintenance of competition between the various fuel and power industries is favoured, because of the stimulus such competition gives to efficiency, and because of the importance of the principle of freedom of choice.

The report has become available as we go to press, so little more is possible on this occasion than a general summary of the committee's recommendations. In considering the aims of a national fuel policy, they suggest that it is "to meet in full the demands of the community for the different fuel and power services, when those services are sold at prices which closely correspond to the relevant costs of production and distribution; to provide for export fuels on such a scale and of such types as can be sold abroad with most gain for the country; to promote the maximum economic efficiency in each use of each fuel; and to encourage the use for particular services of the fuel which gives the best returns on the resources consumed."

Working from this basis, the Committee received over 200 memoranda from more than 60 organisations and individuals. As a result of their deliberations, they have drawn up a list of 40 agreed recommendations, to 14 of which they attach special importance.

Four of this latter list relate to solid fuel burning appliances, for which a room efficiency of 40% using coal is suggested. So far as industry is concerned, it is suggested that there should be a great increase in the service for providing industry with advice on fuel efficiency.

Electricity tariffs, it is recommended, should discriminate between peak and off-peak use, and immediate steps should be taken to make extensive practical trials of the various methods of measuring or controlling the consumption of electricity at system peak hours. In making these recommendations, the Committee recognises that large technical and economic problems arise.

Although the idea of an overall policy executive committee is rejected, the Committee does see a strong case for the establishment of a specialised body to study existing and alternative pricing methods and advise the Minister on the price and tariff policies of the nationalised fuel industries. Accordingly, the setting up of such a committee of five to seven independent members is recommended. So is the establishment of a Joint Fuel and Power Planning Board, composed of representatives of the nationalised fuel boards. This should have an independent chairman and members should be chief officers or members of the governing bodies of the other boards. The Board should have no powers to override the authority of the constituent industries, but would consider co-operation between them. It should have a technical staff to carry out detailed studies.

Both the Tariffs Committee and the Advisory Board should publish full annual reports on their activities.

Electricity

Specific recommendations relating to electricity include the early consideration by the Tariffs Committee of present domestic electricity tariffs. Purchase tax on electric fires should, it is considered, continue at 100% because of their contribution to the peak problem, but purchase tax on hot cathode fluorescent tubes should be abandoned.

The maximum demand tariffs applied for industrial supplies should be on a monthly rather than a yearly basis. Tariffs for "standby" and similar supplies should directly reflect the costs of administration involved, and of connecting and supplying the consumer. "Restrictive" contracts concerning the length of time for which factory generating plant may run should be publicly and permanently abandoned.

The report includes a number of technical appendices discussing such matters as comparative efficiencies of production and utilisation for the various fuel industries. It is hoped to deal more fully with these matters and with the implications of the main recommendations in a later issue.

Our readers' views ...

Container Heating

IN reading your article, dated July 31, 1952, entitled "Electric Heating of Containers" we were very surprised to note the author's suggestion that mains frequency induction heating involves a power factor of 60% or less (if uncorrected).

As manufacturers of mains frequency induction heating equipment, we feel that this statement ought not to go unchallenged as, with suitable design, it is possible to obtain a power factor in the region of 90% in the majority of cases and only in exceptional applications does it fall much below this value.

The principles involved are not by any means new, but it is the comparatively recent introduction of superior insulating materials which has made this form of heating a practical proposition. We do know, however, that some prejudice still exists due to misunderstanding about the power factor obtainable and which we feel is the result of the original "hit and miss" methods adopted in early designs.

A. D. Gilbert

BEANWY ELECTRIC LTD.,
BIRMINGHAM, 11

◆ ◆ ◆

Fan Drives

WE are indebted to Mr. R. H. Young for his excellent article "Induction Motors for Fan Drives" (ELECTRICAL TIMES, August 28) and for the instructive way in which he sets out typical fan characteristics.

May I suggest that when expressing losses of slip couplings or other slip devices, the orthodox input/output method be adopted as for all other efficiency calculations. On page 350, column 2, paragraph 1 and page 351, column 1, paragraph 2, the slip loss is compared with "full load power" which tends to infer losses are not so large as they actually are. At 50% fan speed, fan b.h.p. is 12½% of maximum but slip losses are 100% of the fan b.h.p. This loss is of a major order.

At 66·6% speed (point of maximum slip loss) the fan b.h.p. is 29·5% maximum h.p. approximately, but the input is 44·5% approximately, i.e. the efficiency is 66·6% and the slip loss 50% of the fan b.h.p.—again a major loss.

In the case of boiler fan auxiliaries, the design rating (full load power) has no practical significance as the fan at m.c.r. would be running at approximately 85% speed. There appears to be no justification for referring slip losses to a power rating which in practice never occurs.

The slip losses of a slip coupling or slip-ring motor, when regulating the speed of a boiler fan through its working range, are of a major order. The variable-speed a.c. motor having losses of a minor order, despite its higher capital cost, becomes an economical and practical proposal and has on that account been extensively applied to modern power station boiler auxiliary drives.

A. H. Pickering

BIRMINGHAM, 28

◆ ◆ ◆

Static on Cars

IN your issue of August 28 I read with considerable interest Mr. T. D. Crabb's letter giving his experience with static electricity on private cars, as, several years ago whilst resident in Dumfries I experienced a similar phenomenon.

My car at the time was a 1933 model Standard Nine Saloon, and not long after I took delivery of it I noticed that, after a run, if I got out of the car and then immediately touched the door handle or the edge of the door I experienced a distinct shock to my hand and wrist. On several occasions I was able, by carefully approaching my knuckle to the edge of the door, to draw an appreciable spark, quite audible to anyone standing in the vicinity. As the phenomenon occurred only after a comparatively fast run in warm sunny weather, I came to the conclusion that it was the car that had become "charged" probably by friction with dust, etc., in the dry air.

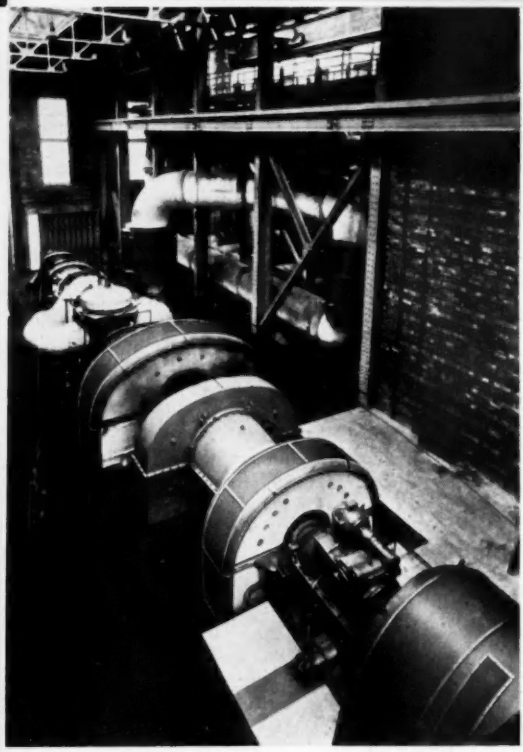
I have had over thirty years driving experience during which time I have driven many makes of cars, but this was the only one on which I have noticed the effect.

D. M. Thornton

GALASHIELS

MANCHESTER'S

Details of the construction of



FOLLOWING on the news of the successful preliminary test runs on the Metropolitan Vickers Electrical Co.'s gas-turbo-alternator, installed at the Trafford Power Station, Manchester, further details have now been released of the arrangement and construction of the machine.

As we mentioned in our issue of August 14, the plant operates on an open compound cycle and consists of a low-pressure compressor, an intercooler, a high-pressure compressor, a heat exchanger, a main combustion chamber, a high-pressure turbine, a reheat combustion chamber, and a low-pressure turbine. The air or gas flows through these items in the order named, and the final exhaust passes through the heat exchanger before discharge to the chimney stack.

As the set runs in parallel with the Grid, the low-pressure turbine, which is directly coupled to the low-pressure compressor and the 15 MW generator, runs at a constant speed of 3,000 r.p.m. under control of a speed governor regulating fuel admission to both combustion chambers.

The high-speed turbine and high-pressure compressor, which are also directly coupled, run at a speed determined by the load conditions—5,500 r.p.m. at full load. Although the combined length of the two units is 80 ft, the overall length is brought up to 96 ft by the introduction between the units of the reheat chamber.

Before incoming air is admitted to the l.p. compressor, it is passed through a Precipitron electrostatic filter, which removes those solid impurities that might impair the efficiency of the compressor blading.

Starting

At the moment, gas oil is being used as the operating fuel, but later it is hoped to modify the plant to run on heavier grade oils. On starting, the h.p. line is rotated by a 400 h.p. a.c. direct-coupled starter motor, and fuel is gradually admitted to the main combustion chamber. When the unit reaches a speed of about 3,000 r.p.m. the motor is disengaged and the system is then self-sustaining. During this period, the l.p. unit starts to rotate slowly because of the gas discharge passing through the l.p. turbine. Fuel is then admitted to the reheat chamber, and the speed of the l.p. line ncreases to 3,000 r.p.m. When the set is idling, the h.p. line also settles down to about 3,000 r.p.m.

Compressors and Turbines

The same general construction has been adopted for both compressors, the l.p. unit having 14 and the h.p. unit 15 stages. Fabricated construction has been used for the stators, the rotors being of high-tensile chrome-alloy forgings. The blades, of stainless steel, are held in circumferential serrated grooves.

Two expansion stages are included in the h.p. turbine, which has both stator and diaphragms of austenitic steel with nozzles of Nimonic 75 alloy. The rotor in this case is a molybdenum-vanadium forging, with blades of Nimonic 80A held in axially serrated grooves.

Six stages, however, are used in the l.p. power turbine, which again uses austenitic steel for the stator diaphragms and nozzle blades in the first three stages. The latter are, however, of ½% molybdenum steel for the last three stages.

Variants are also introduced into the blading on the rotor, which is again a molybdenum-vanadium forging with axially serrated blade roots. Here, Nimonic 8A is used in the first row,

GAS TURBINE

the 15 MW unit at Trafford

austenitic steel in stages two and three, and ½% molybdenum steel in the final three stages.

A gear-type pump, driven from the main shaft of the l.p. turbine, supplies running lubrication; starting and barring lubrication being provided by a motor-driven pump. Incidentally, the h.p. line is barred by the starting motor, and the l.p. line by a separate pony motor mounted on the turbine pedestal. A jacking pump is also provided to give oil at high pressure to the l.p. line bearings during slow-speed barring.

Heat Transfer

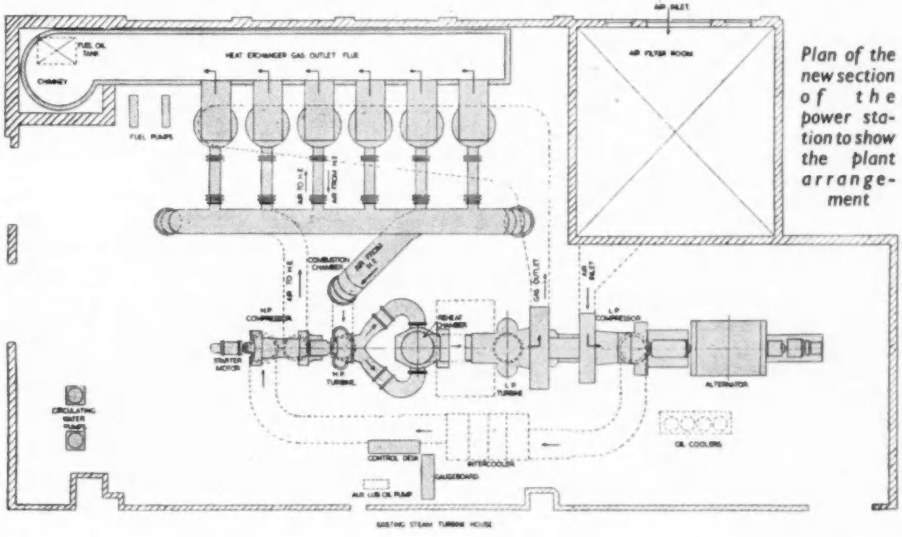
The intercooler consists of four nests of wire-wound Still-type brass tubes, each nest containing 232 tubes, 12 ft long by 1 in. o.d. by 18 s.w.g. thickness. As the bottom header is of the floating type, no difficulty arises due to relative expansion of tubes and shell.

Six vertically mounted heat exchangers, each containing 2,005 mild-steel tubes 21 ft long by 1 in. o.d. by 16 s.w.g. thickness serve to transfer exhaust heat to the h.p. air. Again, particular care has been taken to avoid leaks due to cyclical expansion and contraction.

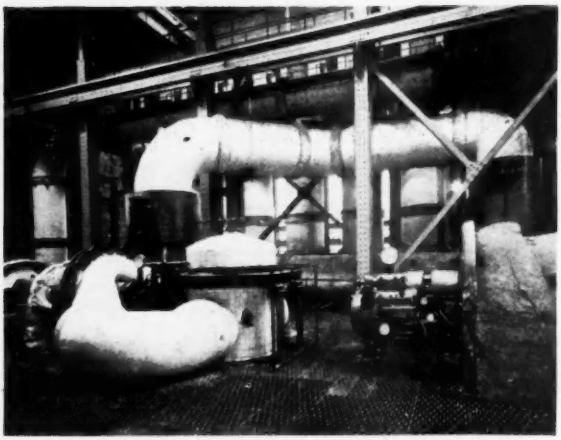
Mounted in a vertical duct connecting the top heat exchanger air bus-main and the h.p.

The power station at Trafford in which the gas-turbo-alternator is installed

turbine inlet is the main combustion chamber. This has an outer casing of mild steel some 42 in. in diameter, and an inner primary chamber wall of stainless steel. Fuel is fed in the downstream direction through four main burners and one auxiliary or idling burner, the



Plan of the new section of the power station to show the plant arrangement



The reheat chamber with the h.p. line on left and the l.p. line on the right. Note the size of the transfer ducting between sections

latter having sufficient capacity to maintain the unit in an idling state.

In view, however, of the higher temperatures involved, the construction of the reheat chamber is different, the gases being given a swirling movement by tangential admission. Only one burner, with a combined main and ignition jet, is used in this chamber.

Ducting

Due to the high temperatures concerned and the large volume of gas which has to be handled, the problem of designing suitable ducting to absorb the expansions without undue stressing was formidable. A new type of flexible expansion joint was therefore designed, consisting of two annular discs of steel plate, which are pivoted at the inner edges to the duct itself and at the outer edges to an intermediate ring. These form a flexible collar, annular discs of thin flexible metal effecting the necessary gas seals at the pivoting points. The duct can then flex by straining the annular discs to concave or convex formation as required. The maximum stress in such a construction is far less than would occur in a conventional corrugated section.

Control

The fuel flows by gravity from a service tank, through filters to two Towler motor-driven pumps, each of which is capable of delivering 1,686 gallons/hr against a pressure of 1,000 lb/sq in. One pump alone is normally sufficient to meet the plant requirements, the other in reserve being brought in automatically should the fuel pressure drop.

From the pumps, the fuel passes through two overspeed emergency trip valves, one for each turbine. These follow normal steam practice, the valves being held open by lubricating oil pressure, and tripped by the release of the pressure, in the event of overspeed, by either of the turbine governors.

From the emergency trip valves, the fuel passes to the temperature-control fuel valve, which regulates admission so as to prevent excessive gas temperatures in the turbines. From the temperature-control valve, the fuel then passes on to the constant-speed governor valve, which is of the balanced-needle type and is operated directly from the speed governor arm. The governor itself is gear-driven from the l.p. turbine spindle, and incorporates speeder gear for operation by hand or by remote electric control.

After the speed-control valve, the fuel divides into two lines, one going to the main combustion chamber and the other to the reheat chamber. The main fuel supply to each chamber passes through a hand control valve and an isolating valve, a tapping upstream from the hand control valve to the main combustion chamber supplying fuel to the auxiliary burner. Interlocks are provided to prevent the set being started with the hand control valves open, as this would result in premature admission of fuel to the main burners. The isolating valves are controlled by magnet valves, which when switched on admit pressure oil to the operating servo-cylinders and thus open the isolating valves.

Interlocks

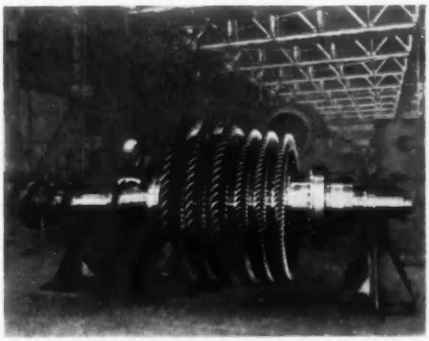
A number of interlocks are provided to safeguard against a wrong sequence of starting operations. Thus, for barring, the starter motor is interlocked with the auxiliary oil pump and one of the circulating water pumps, so that the starter motor cannot run unless these two pumps are running. For starting, the starter motor is interlocked with the electrostatic air filter, the l.p. line barring motor, one of the main fuel pumps and one of the circulating water pumps. A further interlock ensures that the reheat chamber cannot be lit before the main chamber.

Generator

The a.c. generator is rated at 17,650 kVA, 6·6 kV, three-phase, 50 c/s, and is direct coupled to the gas turbine. It is of standard M-V. construction with a welded stator frame. The stator winding is of the involute type, and a closed-circuit ventilation system is provided with a water-cooled air cooler mounted in the foundation below the machine. Cooling air is recirculated by means of fans mounted on the ends of the rotor.

Excitation is obtained from a main exciter and a pilot exciter, both direct coupled to the main generator shaft. The rotor sliprings are situated one at each end of the rotor.

The unit was first put on load on Wednesday, August 6, when Mr. A. R. Cooper, Divisional Controller of the North-Western Division of the B.E.A., was present. It is not considered by Metropolitan-Vickers Electrical Co. that this represents the final design, and it is probable that many modifications will be introduced in the light of operating experience.



The rotor of the l.p. turbine seen in the shops

ELECTRONIC STERILISATION

THE possibility of using high-velocity electrons for killing bacteria and other micro-organisms on a commercial scale has been under investigation in the United States for several years. The main advantage of this process, particularly as regards foodstuffs and pharmaceutical products lies in the fact that the extensive damage caused by heat or chemical sterilisation can be avoided.

In this country, a certain amount of work has been carried out by the Food Investigation Organisation of the D.S.I.R., with the co-operation of the Radiotherapeutic Research Unit of the Medical Research Council at Hammersmith Hospital, mainly on the sterilisation of foodstuffs.

Recently a meeting was held at the D.S.I.R., at which representatives of many of the leading pharmaceutical and chemical firms were present, to discuss the application of this form of sterilisation. The position in America was outlined to the meeting by Dr. R. S. Hannan, of the Low Temperature Research Station D.S.I.R., who had recently spent two months in the United States investigating the matter.

Fundamentally, both high-velocity electrons and gamma rays were being studied. The former were obtained from electron accelerators with effective anode voltages of 2 to 3 million volts (but up to 15 million volts had been used). Gamma radiation was obtained from radio-active sources, the principal one experimentally used being Cobalt 60 which had a radiation energy of about 1 MeV. These voltages were not sufficiently high to induce radio-activity in the irradiated product.

The work on estimating dosages required to kill organisms was still going on, and it had been found that larger organisms were more easily killed than small.

Certain side effects were present in the form of chemical changes, mostly brought about by free radicals caused by the irradiation of water molecules. These changes were mostly oxidative in nature and in foodstuffs could produce changes in flavour.

Present progress

In the U.S. extensive work had been carried out in the M.I.T., using a Van de Graaf 3 MeV generator. A pilot plant, also using a Van de Graaf machine, was being built for industrial use in the workshops of the High Voltage Engineering Corporation. Gamma-ray work was being carried out by several universities, using 1,000 curie Cobalt 60 sources.

In Britain, work was not so far advanced. Most of the Van de Graaf generators were being used for positive ion acceleration or X-ray work, and those suitable for electron acceleration were heavily committed. A Capacitron, under construction in London, should be available shortly, and a few Cobalt 60 sources had been made available, mostly for hospital work by Harwell.

Industrially, I.C.I. and Metropolitan-Vickers Radiation Laboratory had collaborated in experiments, using an 8 MeV linear accelerator.

Problems and Practice

IN ENGINEERING

Lamp Testing

YOUR correspondents who recently commented on "lamp-testing" should, I feel, be cautioned that the use of unprotected lamps for checking motor terminal voltages is a dangerous practice. The use of a single lamp is particularly risky, as it is so easy to unthinkingly put the lamp across phases after checking phase to earth voltages. If no other means are available except the use of lamps, then at least they should be shielded in a suitable container and a fuse inserted in the circuit. The leads should terminate in insulated prongs, and the lamps should be of equal wattage.

Mr. Marsh has pointed out possible conditions which may be present but remain unrevealed by voltmeter testing, but by connecting a resistance, say, of 200 ohms across the voltmeter this objection to a voltmeter is overcome. Thus a voltmeter connected across a 200-ohm resistance, with a fuse in circuit, is a combination, suitably housed and fitted with insulated pronged leads, which makes up the testing set used by the writer.—*R. A.*

Mysterious Volts

DURING a recent inspection of main 6·6 kV busbars, an interesting, and, at first, disturbing incident occurred. Before proceeding to relate the experience, I had first better explain that there are two sets of busbars, lying in adjacent chambers, either set of which can be used.

Load had been transferred to the auxiliary busbars, and the bus-coupler o.c.b. opened. In accordance with usual practice, a permit-to-work card had then to be issued, and the usual procedure of testing with an h.t. voltmeter, flashing to earth, and then connecting the three busbars to earth, was commenced.

Everything proceeded smoothly to the point where one end had been earthed. On touching the other end with the earthing spike, it was noted with surprise that a discharge took place on each bar, not only once, but repeatedly.

Referring to the diagram, the bus-section o.c.b. was opened, and the discharge stopped at end A. On closing it, the discharge was again present. It was decided to measure the voltage of this discharge, and after taking the precaution of first testing with the h.t. voltmeter, and obtaining no reading, voltage readings were taken between each bar and earth as follows:—

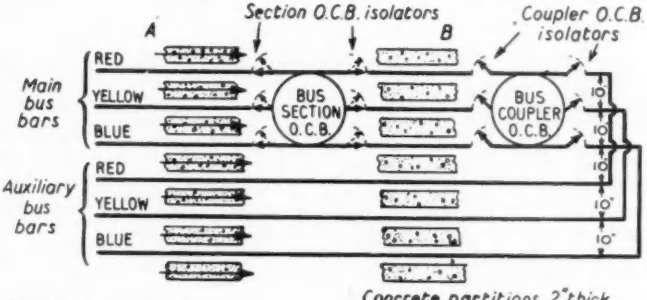
Blue: 0·8V; yellow: 0·5 V; red: 0·2 V.

These voltages were found to be a.c., thus ruling out a possibility of static charge. A leakage of some sort was now suspected, or possibly a voltage gradient on the main earth due to a leakage at some other place. Accordingly, the main earth was removed from the busbars and a separate water pipe earth was connected, but still the voltage was present. Eventually, induction from the auxiliary bars was suspected, and to prove this, all the earths were disconnected, and voltmeter connections made between each end of the bars with results as follows:—

Red: 0·2 V; yellow: 1·2 V; blue: 3·5 V.

It was now realised that as heavy currents over 1,000 A. were flowing in sections of the auxiliary busbars, and as the spacing between adjacent live and dead busbars was only 10 in., they were functioning as a simple current transformer.

This goes to prove the wisdom of "earthing" busbars at *both* ends, although in this case, induced voltages were small.—"*Shift Engineers.*"



Busbar layout referred to in the accompanying notes

B.A. meets in Belfast

Electrical engineering papers were plentiful in this year's programme

ONCE again the annual meeting of the British Association for the Advancement of Science has broken records for attendance. There is every indication as well that the interest created by the papers read at Belfast was well up to standard. Certainly this applies to those dealing with engineering, which were heard not only at the Section G (engineering) meetings, but also in the programmes of Section A (physics and mathematics) and Section L (education).

Transmission Lines

Amongst the most interesting papers presented at Belfast from an electrical engineering viewpoint was Professor R. O. Kapp's consideration of the calculation of transmission line constants. From the usual long line formulae, he developed expressions requiring for computation purposes only the circular functions which are available in any office.

The argument presented was developed from the usual formulae

$$\left.\begin{aligned}\mathbf{E}_s &= \mathbf{A}\,\mathbf{E}_r + \mathbf{B}\,\mathbf{I}_r \\ \mathbf{I}_s &= \mathbf{A}\,\mathbf{I}_r + \mathbf{C}\,\mathbf{E}_r\end{aligned}\right\} \quad \ldots\ldots\ldots\ldots\ldots (1)$$

From these were developed the usual expressions for the three constants

$$\left.\begin{aligned}\mathbf{A} &= \cosh\alpha\cos\beta + \mathrm{j}\sinh\alpha\sin\beta \\ \mathbf{B} &= \sqrt{\mathbf{Z}/\mathbf{Y}}\,(\sinh\alpha\cos\beta + \mathrm{j}\cosh\alpha\sin\beta) \\ \mathbf{C} &= \sqrt{\mathbf{Y}/\mathbf{Z}}\,(\sinh\alpha\cos\beta + \mathrm{j}\cosh\alpha\sin\beta)\end{aligned}\right\} \quad \ldots (2)$$

and thence

$$\left.\begin{aligned}\alpha &= l\omega\sqrt{LC}\sqrt{\frac{\sec\theta - 1}{2}} \\ \beta &= l\omega\sqrt{LC}\sqrt{\frac{\sec\theta + 1}{2}}\end{aligned}\right\} \quad \ldots . (3)$$

In these expressions **Y** and **Z** are the shunt admittance and series impedance of the line, which is of length l. $\mathbf{Z} = \mathbf{R} + \mathrm{j}\omega\mathbf{L}$ and $\mathbf{Y} = \mathrm{j}\omega\mathbf{C}$

$$\theta = \tan^{-1}\frac{\mathbf{R}}{\omega\mathbf{L}}$$

The rest of the paper is concerned with a careful consideration of the approximations that can be made in these expressions within the necessary limits of accuracy. The approach adopted is a discussion of the velocity of wave propagation along the transmission line, which is written

$$l_0 f = \frac{1}{\sqrt{LC}\sqrt{\dfrac{\sec\theta + 1}{2}}}$$

Where l_0 is the exact value of one wavelength and f is the frequency in cycles/second.

First, it is shown that $\sqrt{LC}$ may be written $\dfrac{1}{0{\cdot}98C_0}$, where C_0 is the speed of light. The 2% difference is accounted for by the magnetic field within the conductors of the line.

Next, the expression $\sqrt{\dfrac{\sec\theta + 1}{2}}$ is considered, this being a measure of the "braking effect" of the conductor resistance. In practice $\tan\theta$ varies between 0·1 and 0·2 and for such values $\sec\theta$ is little more than unity. The error in equating the expression under the square-root sign to 1 is certainly less than $\frac{1}{2}$%.

Making these substitutions into equations 3, Professor Kapp obtains $\beta = 0{\cdot}099\,l$ for a 50 c/s supply, where l is expressed in miles.

The next simplification is justified by the fact that, for lines up to a few hundred miles in length, α is very small. It may be shown that $\alpha = \beta\tan\dfrac{\theta}{2}$. In practice $\tan\theta$ varies between 0·1 and 0·2, and so $\tan\dfrac{\theta}{2}$ will not exceed 0·1. In consequence, no great error is made if $\cosh\alpha$ is put equal to 1 and $\sinh\alpha$ to α.

Further, since values of θ occurring in practice are small, there may be written

$$\tan\frac{\theta}{2} = \frac{\theta}{2} = \frac{\mathbf{R}}{2\omega\mathbf{L}}$$

Then for 50 c/s working, $\alpha = 0{\cdot}86\left(\dfrac{\mathbf{R}}{\omega\mathbf{L}}\right)l \times 10^{-3}$

If $\mathbf{R}/\omega\mathbf{L}$ is written as r, the following forms are available for the transmission line constants.

$$\mathbf{A} = \cos(0{\cdot}099\,l) + \mathrm{j}\,0{\cdot}86r\sin(0{\cdot}099l)\,l\,10^{-3}$$

$$\mathbf{B} = \sqrt{\mathbf{Z}/\mathbf{Y}}\,[0{\cdot}86r\cos(0{\cdot}099\,l)\,l\,10^{-3} + \mathrm{j}\sin(0{\cdot}099\,l)]$$

$$\mathbf{C} = \sqrt{\mathbf{Y}/\mathbf{Z}}\,[0{\cdot}86r\cos(0{\cdot}099\,l)\,l\,10^{-3} + \mathrm{j}\sin(0{\cdot}099\,l)]$$

The formulae, which can be used without

tables of hyperbolic functions, are arrived at, as explained above, by making a series of approximations. The errors involved are not all additive; some of them tend to cancel out. Consequently, the total error is very small, and does not reach 0·7% for either the real or the imaginary component of any of the constants for line lengths up to some 600 miles.

Gas Breakdown

On Monday morning Sections A (Physics) and G (Engineering) combined for a symposium of papers on electrical discharges in gases. Professor F. Llewellyn Jones (University College, Swansea) contributed the first of the papers read, a description of recent experimental work on the electrical breakdown of gases.

Increased interest in gaseous breakdown today is, he said, due to the use of compressed gases for h.v. insulation, and to the importance of having reliable contacts in electrical communications equipment. In its three broad aspects (low pressure breakdown, sparks in the atmosphere, and breakdown at high voltages in compressed gases) the mechanism appears so different that separate theories have been proposed. At Swansea investigations suggest that there are basic principles common to all three aspects.

At low pressures, the influence of the cathode is investigated by laying a carpet of atoms of one kind on a base of atoms of another kind. The change of secondary ionisation with this altered surface is observed, and the breakdown mechanism depending on primary and secondary ionisation processes is shown to be largely controlled by the nature and geometry of the cathode.

For sparks in the atmosphere, experiments carried out elsewhere have led to the conclusion that secondary ionisation plays no part in breakdown, and theories based on space charge effects have been advanced. Analysis shows these conclusions to be erroneous. Precision experiments on ionisation just prior to sparking show that breakdown in uniform films at this higher pressure is again controlled by primary and secondary ionisation processes, their relative importance being governed by cathode surface and geometry.

For compressed gases at very high voltages, Paschen's Law fails. Experiments at Swansea have shown that in these conditions electrons can be produced by cold field emission from the cathode, thus accounting for the departure from the law. Finally, in the case of micro-discharges such as those found in telephone contacts, the mechanism again involves cold extraction of electrons from the cathode by a field intensified by positive ions lying on contaminating surface layers.

Summing up, in the generalised paper here put forward, breakdown is the consequence of ionisation currents in the gas and a consequence of the development of ionisation currents by primary and secondary processes. No single secondary process always predominates.

Cold electrode emission, mentioned by Professor Llewellyn Jones, was considered in more detail by a colleague at Swansea, Dr. C. Grey Morgan. He pointed out that the insulating properties of a gas depend largely on the rate at which initiatory electrons are produced. Electron production is found to be far greater than can be accounted for by such natural causes as cosmic rays and local radio-activity, and recent work has suggested that the predominating source is the extraction of electrons from the cathode.

A method has been developed at Swansea of detecting the production of a single electron and the measurement of emission, down to a few electrons per second. It has been applied to surfaces of such practical importance as heavily oxidised copper, and emissions of hundreds of thousands of electrons/second have been obtained with electric fields as low in strength as 10^5 volts/cm. The presence of dust, etc., in apparatus exposed to the air causes even greater emission.

Fundamental Process

The fundamental physical process underlying this emission has been shown to be the extraction of electrons from ionic sites on the thick contaminating oxide layers always present on surfaces operated in the atmosphere. Another class of surfaces of great interest comprises those covered with thin tarnish films only a few atoms thick. Here again, unexpectedly high electron currents are found with fields as low as 10^4 volts/cm, but the mechanism has been shown to be different from that with thick films. It is still a cold field extraction process, but the source is not sites of negative ions on the oxide layer, but rather electrons drawn from the underlying metal. Extraction takes place due to the intense field set up by the positive ions lying on the surface tarnish film.

This work at Swansea directs attention to the important part played by electrode surfaces in initiating spark breakdown. The results are of considerable importance in the design consideration of apparatus in which even moderately high voltages may be encountered.

Ionic Constituents and Oscillations

Dr. R. L. F. Boyd (University College, London) discussed the problem of ions in gases, concentrating on oxygen, and the development of a radio frequency mass spectrometer probe. The oxygen discharge has a negative ion concentration only about one-hundredth of that in halogens for a given electron concentration, yet the probability of attachment of electrons to oxygen atoms and to iodine atoms is not very different. Incomplete evidence so far suggests associative detachment as the only process sufficiently rapid to account for the destruction of negative ions in oxygen.

A definite solution to the problem requires a knowledge of the degree of dissociation of oxygen, and for this measurement a microcalorimetric probe has been developed.

To account for high recombination rates found in r.f. discharges in inert gases, a process requiring the molecular ion to be predominant has been proposed. Using an r.f. mass-spectrometer probe, this has been found to be so.

Professor K. G. Emeleus (Queen's University, Belfast) dealt with some features of plasma oscillations at high frequency. When a minute current passes through a gas, that gas is practically undisturbed, and the motion of electrons is regular. When, however, the current density in an enclosed arc is increased until ionisation is almost complete, violent surges occur, in which any distinction between ionised and un-ionised gas is almost non-existent. Between these extremes an enormous variety of intermediate types can be produced. Generally speaking, the electrical phenomena are like those of ordinary fluids in hydrodynamics complicated by the electromagnetic forces between the carriers of electricity, and by the impact phenomena between electrons and ions on the one hand, and uncharged gas particles on the other.

Observations suggest that in gas-filled rectifier tubes and triodes a catastrophic collapse of regular motion of the electrode takes place within a few mm of the cathode. Ultra-high frequency oscillations and various other electrical and optical phenomena are associated with this breakdown.

Lightning

In his paper, "The Leader Strokes of the Lightning and Spark Discharges," Mr. C. E. R. Bruce (E.R.A.) outlined the transition-to-arc theory of the leader strokes of the lightning and long spark discharges, emphasising how this was contributed to by the wide range of the E.R.A.'s investigations in discharges in gases —from the study of the breakdown of voids in dielectrics to that of many cosmical phenomena from the point of view of their being possibly electrical discharges.

The earlier recombination theory of the lightning leader stroke is incompatible with the large currents of hundreds or thousands of amperes which flow in it. These last have been demonstrated both by records of the currents flowing into the upward leader strokes from the Empire State Building, and by the changes in the electric field which are observed to accompany the propagation of normal downward leader strokes from the cloud. With currents of this magnitude flowing for hundredths of a second, breakdown to arc will be complete at this stage.

CHARACTERISTICS OF LIGHTNING

	Earlier Theories	E.R.A.
Average pre-discharge potential gradient (V/cm)	10^4	$<10^2$ to $n \times 10^2$
Potential of thunder-cloud charge (V) ...	$n \times 10^9$	$n \times 10^7$
Current in leader stroke ...	0·1 to 1	10^2 to 10^3

The leader stroke thus represents a partial short-circuit of the field, so that large differences of potential are built up between it and the surrounding space. These cause corona currents to flow out laterally from it, and it is these which account for the large currents in the leader channel, and for the large field changes caused by it. These currents were assumed to be proportional to the square of this difference in potential, as they are observed to be in the laboratory and the value adopted for the constant of proportionality was about 4×10^{-17} i.e., similar to that observed in laboratory experiments. The theory seems to account satisfactorily for the field change and current measurements.

The potential gradient required to maintain that part of the channel already formed is only that required for a high current arc in air, i.e., about 10 V/cm. This view thus also accounts for the propagation of the leader stroke throughout a space in which the *average* potential gradient is only of the order of 100 V/cm, in contrast to the value of 10^4 V/cm previously regarded as necessary.

Recent Researches

This general physical picture of low pre-discharge fields and high lateral corona currents has been corroborated by recent researches by

Pierce at Cambridge (Thesis, 1950). The value found by him for the corona constant, k, viz. about 10^{-18}, is, however, much lower than Mr. Bruce's, but the latter believes that there are reasons for thinking it is too low, and all that can be said is that k is probably of the order of 10^{-18} or 10^{-17}.

This view of the phenomena suggested that the steps by which the initial leader is often observed to progress may represent the transition of lengths of the channel from corona to arc discharge, and that it is the occurrence of this transition which marks the onset of instability in the long or "infinite" spark. Investigations on the long laboratory spark by Komelkov and later by Akopyan and Larionov in U.S.S.R. would appear to have established that the characteristics of the leader channel *are* those of the electric arc, namely, a current density of the order of 1,000 amp/cm^2 and a potential gradient along the channel of about 50 V/cm.

Experiments

Amongst the papers presented to the mathematics sub-section of the Association was a consideration of the "Logic of Experiment," by Dr. J. Bronowski (N.C.B.). In it he developed the basic ideas which underlie all science, and which have proved so powerful in reshaping the world in the 300 years since first they came into practice.

The scientific notion that the processes of nature have an orderly structure of a geometrical kind came to Descartes and Hobbes with an almost mystic force; their generation called them "in love with geometry." The great generation of Newton which followed was inspired by this. Hume pointed out, however, 100 years later, that the axioms of geometry make no reference to the passage of time; but all the natural sciences must include time as a variable. This has remained the classical criticism of scientific inference for 200 years.

Dr. Bronowski shows that this criticism confuses two notions of time : unexperienced time, which lies in the future, and experienced time, which is already past and recorded in nature. The aim of science has been and remains to arrange its knowledge in this way, as a rigorous system with the structure of a geometry; and it owes its success to pursuing this aim. It is, of course, true that science continues to fall short of certainty; but this is because we can only sample the processes of the universe. We never know all that has gone on, even in the time and space of our own experience.

How do scientists try to find these defining properties and processes out of which their theories are built—atoms, or mesons, or genes, or any other units from which we try to make up the fundamental structure in nature? The speaker held that all experiments must be understood as messages from nature. Science assumes that these messages are meaningful, and indeed its basic assumption is shown to be that the messages of nature are as meaningful as it is possible to be. Then the procedure of scientists amounts exactly to finding the code in the messages. This conception of the scientific process relates it closely to the modern theory of communication, and the author showed the likeness in detail.

Presidential Addresses

Probably the most interesting of the section president's addresses so far as electrical engineers are concerned was that of Professor W. Wardlaw (Section B, Chemistry). Dealing mainly with inorganic chemistry, he discussed many materials which have recently grown in engineering importance. Zirconium is an example. Excellent corrosion resistance is its outstanding property, while its very small affinity for neutrons commends its use as a structural material in atomic power plants. At present electrolytic methods of preparing zirconium are being explored.

Germanium, now being obtained from coal dust, is another instance of a metal made important by a new invention. The development of the fluorescent lamp has, in its turn, created a demand for tons of high-purity phosphors. In their preparation there is active co-operation between the inorganic chemist, the physical chemist and the physicist. Another field where this applies is the development of fluorine compounds as refrigerants.

In Section G (Engineering) the president was Sir Ben Lockspeiser (D.S.I.R.), whose address was devoted to "Progress in Aeronautical Science and Engineering," a most interesting subject which can find no space in these columns. Members of Section A (Physics and Mathematics) heard Professor A. Tyndall speak of recent contributions to experimental physics from Britain. He considered, naturally, mainly the physics of sub-atomic particles, but mentioned other branches such as radio-astronomy and X-ray diffraction.

The president of the Association, Professor A. V. Hill, in his opening address, discussed "The Ethical Dilemma of Science." In this widely reported speech, he reached the conclusion that there is not really any special ethical dilemma which scientific men have to

meet. But like others, they have moral issues to face.

Technological Education

A survey of industry's requirements for higher technological education was presented to Section L (Education) by Maj.-General C. Lloyd (City and Guilds of London Institute).

At present there are, in England and Wales, about 450 local technical colleges where full-time and part-time courses in the different branches of technical trades and engineering are given. Only the major technical colleges, about 27 in number, provide courses up to degree standard. These colleges mainly enter students for the external London degree, and have some facilities for research and higher technological studies. Below first degree level, courses lead to qualifications of the City and Guilds of London Institute or to National Certificates. In Scotland there are local technical schools and 17 central institutions. Of the latter, 12 are virtually monotechnics, the remaining five having developed similarly to the major English technical schools.

Engineering courses are provided in 12 of the 16 English universities and university colleges, three of the Welsh colleges and all four of the Scottish universities. The only institution in the United Kingdom which is in any way similar to the technical universities of America and the Continent, is the Imperial College of Science and Technology, which is an integral part of London University.

In the lecturer's view, the universities are capable of making a much larger contribution to the output of technologists. They need to think deeply about the education (as well as the training) of such men. He welcomes the proposal to establish a new technological university, but does not think this will excuse the existing universities from developing their own facilities.

So far as technical colleges are concerned, he advocated a limited number, perhaps six, being chosen for upgrading, such colleges to deal exclusively with advanced work. Moreover, these colleges should be made autonomous, under independent governing bodies, and with a 100 per cent. central grant.

Finally he thought there was need for some such body as a technological grants committee. If it could not be set up, then the functions of the university grants committee should be suitably extended.

Heating Curved Surfaces

THE problem of applying controlled heat to localised areas, which may be curved in one or two planes, is one which frequently occurs in laboratories and in industrial processes. A recent development, introduced by Electrothermal Engineering Ltd., 270 Neville Road, London E.7, under the name of E.R.S. (Electrothermal Rubber Sheeting) goes far towards providing a simple, flexible and robust solution to this problem.

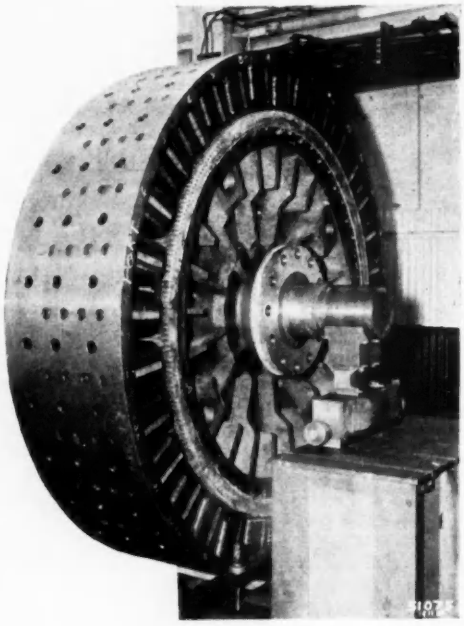
Electric Loading

In appearance, the material resembles a flat sheet of black rubber, but it is electrically wired at 150, 250 or 400 watts/sq ft for mains operation, to radiate heat at controlled temperatures up to 200° C for all applications of heat to flat, shaped or curved surfaces, where the required heat input does not exceed the rated value of the sheet. Three loadings, each with its own maximum temperature are available. Type 1, 150 watt/sq ft, 100° C; Type 2, 250 watt/sq ft, 150° C, and Type 3, 400 watt/sq ft, 200° C. For general applications, Types 1 and 2 are usually found satisfactory, but where rapid temperature rise is required, Type 3 should be selected.

Mechanical Strength

The sheeting will stand considerable pressure, and data concerning stresses up to 1 ton/sq in. is available from the firm on request. Physical dimensions of the sheet vary according to customers' requirements, but strips of virtually any length can be supplied with widths ranging up to 6 ft. Standard sizes range from 1 ft by 6 in. up to 8 ft by 4 ft. Mains supply is normally 100/120 or 200/250 V, a.c. or d.c., but other non-standard voltages can be accommodated. The sheet has a high insulation resistance, is corrosion proof to the great majority of chemicals and is singularly robust.

In industry it has been used with great success as a means of curing the synthetic resin glues used in furniture making, and for the safe heating of chemical apparatus, where spillage is likely to occur or where rough handling is required.



ELECTRO-MAGNETIC COUPLINGS *for Marine use*

B.T.H. development is installed in New Zealand Shipping Co.'s M.V. "Surrey"

IN marine use, the primary advantages of electro-magnetic couplings lie in their inherent elastic and damping properties. These are particularly valuable where the prime mover has a tendency to produce torsional oscillations which may, in the absence of suitable damping, cause tooth separation in the main gearbox, causing damage to the gears. They also greatly simplify manœuvring at slow speeds and greatly reduce the time taken for going from "ahead" to "astern."

M.V. "Surrey"

An interesting example of the installation of such couplings is provided by the M.V. "Surrey," built by Alexander Stephen and Sons, Ltd., for the New Zealand Shipping Co. This is an 8,400-ton single-screw ship powered by two nine-cylinder Sulzer engines, each developing 4,500 h.p. at 225 r.p.m. These engines drive a single propeller shaft through a B.T.H. twin-pinion gearbox, which, with a reduction ratio of 2·23 to 1 gives a propeller shaft speed of 100 r.p.m. at full power. Each engine is connected to its pinion through B.T.H. electro-magnetic couplings. These couplings give a small slip between driving and driven portions so that the actual pinion speed at nominal full power is about 223 r.p.m. instead of 225.

The outer member of each coupling consists of a welded steel ring which forms a magnetic yoke. Thirty-two non-laminated poles of high permeability steel located round the inner periphery, and secured by dowels and set screws, carry the excitation winding. This consists of rectangular copper strip, wound on edge, with treated asbestos between the turns and insulated with mica protected with varnished press-board. The coils are supported in position between moulded insulation end-flanges.

Ventilation

Ventilation is provided automatically, air being drawn into the sides of the coupling and discharged through holes in the periphery. At low speeds—below 150 r.p.m.—the excitation is reduced as this natural ventilation may not be sufficient to prevent overheating.

A steel disc with stiffening ribs is welded to one side of the coupling yoke and the centre is bored and faced to form the coupling flange. For leading the magnetising current to the windings two phosphor-bronze sliprings are provided, and these work in conjunction with a brush-gear assembly which is mounted on the adjacent bearing housing.

The inner member of the coupling consists of a segmental rotor core built up from punchings of low-hysteresis steel and supported on a fabricated steel spider. A double squirrel-cage winding is included in the core with upper bars of high-resistance alloy and the lower bars of copper. Each cage has its own short-circuiting connections, which take the form of copper rings, silver-soldered to the bars of the cage windings. No insulation is provided between

the windings and the laminations, a feature which considerably assists heat dissipation from the windings.

Control Gear

The control gear is mounted on an insulated panel housed in a steel drip-proof cubicle. On this panel are the main cam-operated contactors for the coupling excitation, the coupling tripping circuits and fuses, and the alarm gear, which provides audible warning if the excitation is left on when the coupling is stationary. A separate instrument panel carries the ammeters indicating the excitation current, warning lamps and the Klaxon cut-out switch.

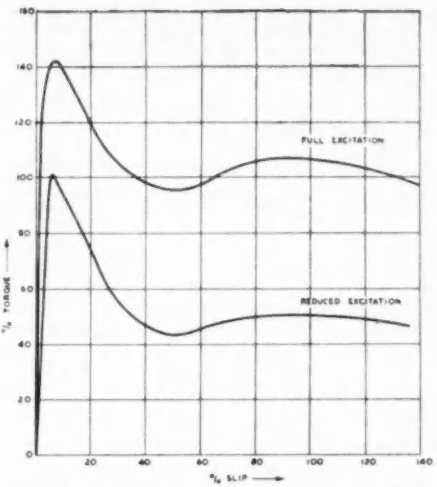
Excitation, amounting to about 40 kW for each coupling, is supplied from the ship's main d.c. system.

Manoeuvring

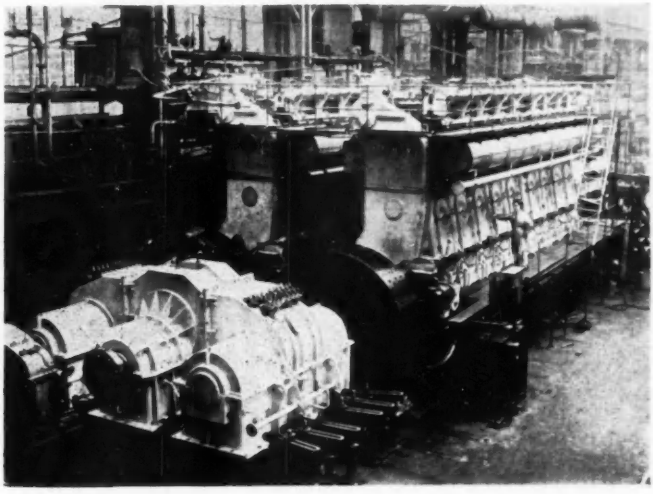
The control levers for operating the couplings have three positions: "Off," "Position 1" (reduced excitation) and "Position 2" (full excitation). The value of exciting current at "Position 1" was adjusted as the result of experience during trials to a value at which the torque imposed on the engines during manoeuvring could be allowed for by the governors without risk of stalling.

When manoeuvring it is possible to run one engine astern and the other ahead, the requisite torque then being transmitted through one or other of the couplings as desired. On trials, a manoeuvring engine speed of 110-115 r.p.m. was chosen, and by setting either coupling lever at "Position 1" with the port engine running ahead and the starboard engine astern, it was possible to accelerate the propeller rom rest to about 40 r.p.m. in either direction in eight to ten seconds.

For emergency reversing, both engines are put into reverse after de-exciting both couplings. During trials, a full-astern order was given with the shaft running ahead at 90 r.p.m. The engine speed was reduced and coupling excitation removed. The engine-starting levers were removed to "Off" and held for 10 seconds before admission of astern air. The engines were then run up astern, the coupling levers moved to "Position 1" and then "Position 2" as the engine fuel was increased. Time between the receipt of the order "Full astern" to bringing the shaft to rest was 42 seconds, and in 61 seconds from receipt of the order the shaft speed was 90 r.p.m. astern.



This graph shows typical slip-torque curves for the electro-magnetic couplings



The couplings can be seen in the shops in position between the 9 cylinder diesel engines and the twin-pinion gearbox

ELECTRONIC MEASUREMENT AND CONTROL

S.I.M.A. Symposium discusses electronics in research and industry, introducing a new feature for instrument users

FOURTH in a series commenced in 1948, a Symposium on Electronic Instruments in Research and Industry organised by the Electrical and Electronics Group of the Scientific Instruments Manufacturers' Association, was opened last week in London. In a short opening speech, Mr. A. W. Smith, A.R.C.S., B.SC., Chairman of the Association, made the point that the group had always shown a lively interest in its customers as exemplified by this series of conferences they had organised, and even more so by a special feature introduced this year, namely, the holding of a Users' Forum, where instrument users' problems could be discussed.

Telescopic Drives

He then introduced Mr. G. H. Hickling, B.SC., A.M.I.E.E., who, in collaboration with Mr. A. Gray, B.SC., both of Sir Howard Grubb, Parsons and Co., presented a paper on "Electronic Control Systems for Large Astronomical Telescopes." Presenting a picture of the astronomical considerations, Mr. Hickling pointed out that as the telescope had to move in relation to the earth to maintain the object in a fixed position in the telescope's eye piece, accurate control of the drive was necessary. Originally pendulum clocks were used for the reference standard, from which were developed tuning forks in association with an electrical drive. Present-day techniques demanded a much higher degree of accuracy, which has been obtained by the use of crystal-controlled oscillators in conjunction with l.f. "R-C" oscillators. The latter combined a high stability with means to effect frequency variation so that the drive could be comparatively easily controlled. Moreover the stability of these "R-C" oscillators was sufficient to enable them to be used as the sole reference if necessary. Mr. Hickling described various applications of this system, and concluded with a reference to its use with a "Photographic Zenith Tube" shortly to be used as a method for determining absolute time.

Papers presented on the following day varied in content from a consideration of semi-conducting ceramics; through electronics in strain measurement, to an account of electronic instruments for electrical research. In the first paper, "The Development of Resistive Elements and Wave Guide Attenuators from a Semi-Conducting Ceramic," by Mr. J. M. Herbert, B.SC., A.R.I.C., of the Plessey Co. Ltd., the author discussed uses of pure zinc oxide in this application. It is possible to control the temperature coefficient of resistivity of pure zinc oxide between high positive and negative values. Adding titanium oxide enables this control to be effected with commercially available materials and also enables the resistivity to be controlled. Small resistors, up to 10,000 ohms in value, and comparable with Grade B carbon composition resistors for tolerance and stability have been made from the compound, and these resistors may be used with surface temperatures up to 200° C. Large sizes only have so far been manufactured, the difficulty of making good electrical connections being the limiting factor. One of the ways in which this material has been usefully employed is in dummy loads for wave guides where satisfactory service has been obtained.

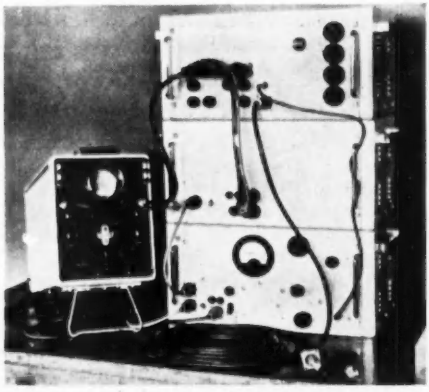
Strain Gauges

An interesting fact was brought to light in the paper on "Electronics in Strain Measurement," by Messrs. D. L. Johnston, B.SC., and D. W. Hobbs, of Elliot Brothers (London) Ltd. Although the bonded resistance wire strain gauge was invented in 1938, early developments in cable making would have made its construction possible 100 years ago. This fact was mentioned during an outline of the history of strain measurement, and more recently strain analysis, leading up to the latest techniques using wire gauges. Of these he mentioned the load cell, which may be used to measure tension or compression pressures up to 200 tons, and was best suited for measuring static loads. Other types used to measure high-frequency strain variations included the double diode accelerometer and a triode accelerometer. In

this type, the anode of the triode moved in space in relation to the strain and in doing so varied the characteristics of the triode.

Comparing electronic and non-electronic systems of amplifying the strain gauge output, it was pointed out that the magnetic amplifier, although having a low input impedance and not adapted for frequencies greater than five cycles/sec, was more reliable in view of the absence of valves. This point was also made by Mr. Hobbs, when discussing instruments in use. The magnetic amplifier load cell indicator, although more costly and less rapid in action, was far more reliable for industrial use. Another type was the self-balancing-bridge strain indicator. This he said was a typical cell incorporating a 12-in. diameter meter scale of 1% accuracy and a traverse time of 8 seconds.

The Authors concluded the paper with a film of the multi-channel pulse system which combined ten input channels, connected to ten gauges, using pulse methods. Each wire gauge was fed with a 10 micro-second pulse at a repetition rate of 10,000 cycles/sec. By combining the outputs in an oscilloscope it was possible to measure either the amplitude or waveform of vibration strains along a cantilever. Moreover, the waveform output of any particular gauge could be isolated and amplified for closer inspection. In answer to questions after the paper, the accuracy of this instrument was said to be within 3%, but this depends on its setting up calibration and, of course, the operator. Sensitivity on the c.r.t. screen was of the order of 0·002 in. of strain per mm. deflection, but this could be improved if making a photographic record.



Capacitance bridge operating at frequencies below 50 c/s for determining moisture content of insulants. In the upper unit is housed the bridge and in the lower the v.l.f. oscillator

Presented by Dr. G. Mole, PH.D., F.INST.P. (E.R.A.), Wednesday's final paper was a review of electronic instruments developed by the E.R.A. for research in the electrical industry. Here the emphasis was on the degree of accuracy required for measuring either transient effects or controlling mechanical operations well illustrated by the first instrument presented. This was used for controlling the sequence of operations in testing circuit-breakers. During the test, the motor driving the generator supplying power to circuit-breaker is disconnected from the mains immediately before opening the breaker in order to prevent its transient effect being fed back to the supply. Hence close timing of both operations is necessary.

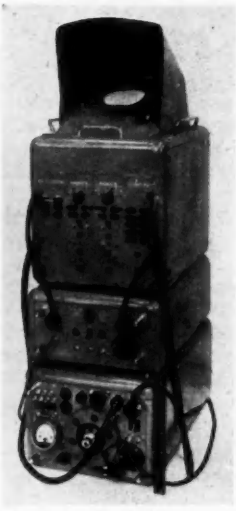
High Speed Oscilloscope

Among other instruments considered by the speaker was a magnetic recording unit, capable of storing records of transmission system conditions immediately prior to a fault. Studying transient voltage phenomena had resulted in the development of high-speed oscillographic instruments. In one such instrument used in measuring radio interference sweep times as low as 0·05 microseconds had been obtained, with a starting time of 0·03 microseconds. The temporal resolution of this oscillograph was 1 milli-microsecond, enabling a 500 Mc/s oscillation to be observed clearly.

Tests on paper insulation, by measuring its capacitance variation with frequency, necessitated the use of a very low frequency bridge operating over a range 0·5 to 50 c/s incorporating a detector whose input impedance, had been raised to well above 10^{12} ohms. Similar techniques have been used in constructing a Dispersion Meter, a portable version of this apparatus.

Electronics were also employed to simulate the behaviour of transmission networks, particularly under transient conditions. In conclusion, the author stressed again the accuracy which the use of electronics had made possible and pointed out that in many cases performance is now limited mainly by mechanical devices associated with the equipment.

Control rather than measurement, supplied the theme of Thursday morning's papers, of which the first was "Electronic Measurement and Control for Industry." In his introduction the author, Mr. J. R. Boundy, B.SC., A.M.I.E.E., of Evershed and Vignoles Ltd., explained that in the system used, physical quantities were converted into the same form which could be used for indicating, recording and controlling.



Magnetic recording unit, for observing fault conditions in transmission systems. The bottom unit is the recorder, and the upper unit the playback equipment

Conversion was made in a transmitter which measured a torque in terms of the magnetic couple required to balance it. Some time was spent considering construction and operation of different types; mechanical, liquid flow, pressure, temperature and displacer level transmitters.

Turning then to control, it was stated that any continuous process could be controlled by breaking down the process into individually controlled loop systems, made up of units—the process controller, measuring unit (the transmitter) and regulating unit. In the former, control is effected by comparing measured values with a preset desired value. This comparison may be made in three ways, by proportional, integral or derivative action.

In practice, each one has disadvantages, and it is usual to combine them to provide accurate control. Several electronic methods of process control were discussed and advantages claimed for them were the elimination of lag, greater accuracy and, an important point under certain conditions, ease of service and maintenance. This point was brought out again during discussion. From the reliability aspect maintenance was rarely needed, for example in one year during the continuous operation of 23 controllers each having three electronic valves, only one valve needed replacement. One of the problems connected with maintenance was that of the instrument mechanic on the site. There had been some opposition in certain quarters to electronics and it was felt that more could be done to train the local technician. On the other hand some industries, notably oil and chemical, had been very co-operative.

Similar problems were discussed in the paper "Electronics in Temperature Control" by Messrs. D. K. Das Gupta, M.Sc., and R. J. Russell-Bates of Elliott Brothers Ltd. Discussing basic control systems, namely the closed loop, in which the controller operates the plant which, in turn, feeds back information to the controller, it was pointed out that one of the problems was that of lag. In process engineering two lags are met—process lag and measurement lag. For analysis purposes these could be combined to form a phase lag. Precision control, however, could eliminate the latter but the former was common to all processes. Another factor facing the engineer was that of change. Out of four variables, load, demand, supply and controller set-point, any one could change. Continuing, Mr. Das Gupta said that the nature and quality of the plant was determined by the control action and potential correction and he followed with a lengthy discussion of control characteristics.

Considerations of a somewhat more practical nature were discussed by Mr. Russell-Bates who outlined types of controller in current service. The shielded vane type was an example of the on/off control and for direct indication of the control the mirror galvanometer/photo-cell type was used. High speed pyrometer heads were also employed but with a heavy case and vibrationless mountings, tended to be rather bulky. Coming back to the question of opposition to electronic control it was suggested that magnetic amplifiers might be preferred. Types incorporating this principle had been evolved, but a drawback to their use was lack of flexibility. This could be overcome by combining magnetic and thermionic principles, and consideration was given to controllers based on magnetic and electronic amplifiers, concluding with an outline of a recently developed three-term all-electronic controller.

Applied Ultrasonics

The final paper read at the Symposium was heard that afternoon. In "Application of High-power Ultrasonics," by Dr. B. E. Noltingk, Ph.D., A.Inst.P., of Mullard Research Laboratories, presented a broad survey of uses of ultrasonics. Passing briefly over the development of this subject, the author then outlined what was considered to be the mechanism of the effects of ultrasonics. In many cases these follow from the phenomenon of cavitation, which is the implosion of gas bubbles in liquids. It was also stated that ultrasonic effects not due to cavitation, probably result from high particle velocities and accelerations. By reducing the ambient pressure, which alters only the

cavitation threshold, it is possible to deduce which action is responsible for the effect.

Turning then to applications of ultrasonics, the speaker pointed out that it was thus possible to classify each application by whether or not it results from cavitation. The way he had adopted, however, was to classify each according to the science into which it fell. He then categorised most of the ultrasonic applications, discussing each in turn. Emulsification and dispersion, with reference to cleaning, were mentioned, indicating the varying degrees of success obtained with different materials. Metallurgical applications were concerned especially with tinning of aluminium. Other fields in which ultrasonics had found use were chemistry, micro-organisms and therapy. Two further interesting uses were in smoke precipitation, although here the mechanism is not yet fully understood, and in drilling hard metals and materials, for which conventional methods have proved ineffective.

Users Discuss Problems

Under the chairmanship of Mr. A. J. Philpot, C.B.E., M.A., B.SC., F.INST.P., the Users' Forum on Friday morning used the popular "Brains Trust" technique. The panel of "experts" consisted of Messrs. Brocklesbury, Gasper, Bamford, Colls, Boundy, Simmonds and Dr. Maddock. Questions were invited from the floor, and it is interesting to note that one of the main items with which speakers were concerned was that of reliability. Valves, particularly, were subjected to considerable discussion, from which it was generally agreed that too much was made of the shortness of valve life. Most valves had a long life, in many cases more than the 10,000 hours specified by manufacturers. Moreover, if a valve was going to prove defective, it usually did so within the first 500 hours of its operation. Consequently, artificially ageing valves would do much to single out defectives. On the other hand, several speakers pointed out that in some cases valves were regarded as expendable items, and hence the importance of failure must be considered. If the cost of failure is not high, then is there any real disadvantage if there are valve failures? Engineers could design automatic self-correcting systems, in which failure could be remedied, but were not justified if the cost of breakdown was small.

Another question drew out the fact that electronic engineers sometimes tended to use electronic methods when simpler electrical or mechanical systems would be satisfactory. This, it was felt, could be corrected by considering fundamentals, and choosing the system accordingly, although the point was made that if electro-mechanics were to be used in conjunction with electronics, the question of suitable maintenance staff was of some importance. Moreover, in some industries, using electronics presented maintenance problems, and it was felt that electro-mechanical methods might be usefully employed to introduce maintenance staff to electronics rather than thrust electronics directly upon them.

Round the Exhibition

An imposing array of electronic instruments was on view in the exhibition associated with the symposium. Although less than a score of manufacturers were exhibiting, the variety and scope of exhibits showed to good effect the contribution electronics has already made to the techniques of measurement.

What, for example, is the movement set up in a tag strip when subjected to vibration? A demonstration on one of the stands showed the comparatively simple method employed. The tag strip under test was clamped to a vibration generator and observed in the light of a stroboscope whose frequency was locked, out of step, by one or two cycles/sec., with the vibration frequency. Modes of vibration set up in the strip could be seen clearly under this light.

Some of the equipment mentioned in papers presented at the symposium could also be seen at various stands. One such item was the multichannel strain display, on which could be observed strain vibrations in a cantilever due to the vibration of an eccentrically loaded motor mounted on it. Ultrasonic soldering irons also on view demonstrated their efficacy in tinning aluminium.

Another demonstration showed up surface irregularities in ground steel rod, both before and after lapping. Movements of a sharply pointed stylus traversing the specimen are amplified up to 10,000 times and recorded on a chart or indicated on a meter as average roughness.

Elsewhere, d.c. low-inertia integrating motors provided some fascination for visitors. By reducing friction, iron losses, brush-contact voltage drop to a minimum, an almost linear voltage/speed relationship has been obtained, enabling these motors to integrate a voltage input over time. Two motors, electrically coupled, demonstrated this usefulness. By turning either, operating it as a generator, an exact copy of the movement in the other could be produced.

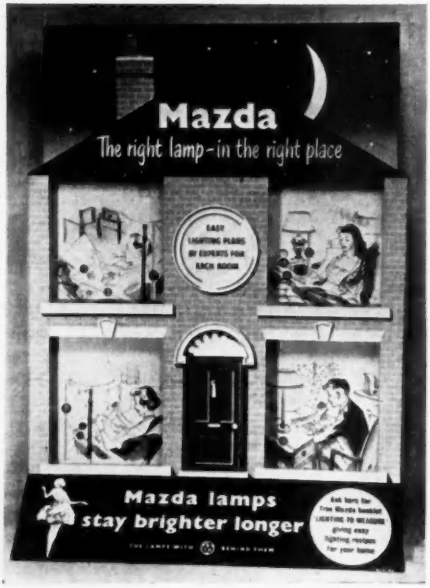
SEASONAL SELLING

Lamp Manufacturers announce plans for their Autumn Sales Campaigns

PUBLICITY campaigns to help retailers sell lamps are announced by many major manufacturers for the coming weeks. Amongst the new sales aids being introduced is a 16-page booklet in two colours which B.T.H. are issuing to boost the demand for **Mazda** products. This publication contains illustrated lighting "recipes" which present to the householder the means of getting most out of his electric lighting.

Zoned Issues

The booklet will be launched successively in three zones of the country, with ample local Press advertising to support it. In the national dailies advertising is to take the form of rhymed couplets in the lighter vein illustrated by humorous artists. For point-of-sale promotion, there are large silk-screen displays for window dressing including some tied to the booklets "Lighting to Measure" theme. Ten new showcards are available, including one to act as a dispenser for lamps and another in the form of a "mobile" display. A new comprehensive lamp catalogue has been prepared.



Siemens are maintaining continuity with last year's "black cat" theme in the publicity for their lamps. In a new counter display a model house is presented which can be illuminated by Siemens lamps switched on at will. New catalogues of Siemens lamps and **Sieray** fluorescent equipment are in preparation.

Crompton Parkinson keep the "happy switch" and the slogan "Switch to Crompton Lamps" in their material. This will be presented on many shopping centre poster sites. A new six-colour counter display is available in a self-locking

two plane arrangement and there is an improved design of the popular string banner. A new 24-page lamp price list is to be produced, together with separate counter leaflets and price cards.

"All the Better to See With," supported by the ingenious "seeing eye" device once more forms the basis of **Atlas** advertising. Thorn Electrical Industries are backing up extensive Press presentation of this theme with a wide range of showcards and with three special window displays suitable for widths from 5 ft. to 14 ft. There is also a useful form lighting display stand.

Variable width window displays feature in the **Ediswan** effort also. A three-piece unit is available, which can be used in any combination of its component parts. To maintain impact, the centre-piece of the display is being produced also as a poster and a showcard.

To advertise **Metrovick** lamps, the makers are leading into their familiar slogan, "When

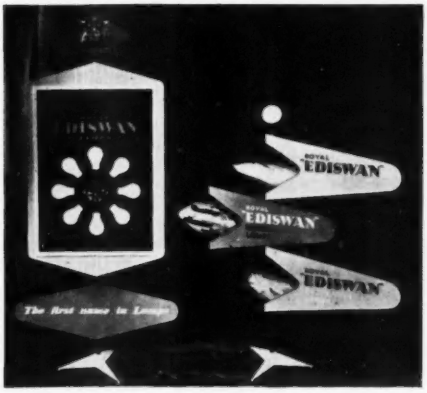
daylight fades . . . Metrovick lamps," with the complementary phrase, "Best light in the world, Daylight." A 32-in high full-colour cut out illustrates this theme, and it is repeated in a showcard. A window display is available in four units dispensing with additional crates.

In Press advertising the quality control theme is to be continued, while for the retailer's use there is a new edition of the lamp catalogue and a pin-up price folder. Fluorescent gear is featured in an attractive folding display, which is supported by a broadsheet giving prices.

Ekco publicity has been prepared in support of a stepped-up marketing policy. Extensive Press advertising is to continue, and a wide range of showcards and brochures are being made available. A new feature is a 30 in. by 24 in. self-supporting window display in six colours which features the "Perfect Pair." A new open/closed indicator in the form of a cut-out lamp is being made available.

In connection with **Osram** lamps, G.E.C. are running the biggest campaign they have yet undertaken. The aim is to sell more lamps to housewives, and press advertising directed to such customers will make the fullest use of colour. For outdoor advertising extensive use will be made of the V-sign theme.

Two standard window displays will back the campaign with a "take home a spare Osram lamp" theme. Several other sales aids are available, including a demonstrator which compares the Silverbright lamp with the standard pearl.



overseas news

Brisbane's Contracts

Tenders for a £4,400,000 generating station project, providing for the duplication of the Tennyson power station, have been approved by Brisbane City Council. The latter agreed to a recommendation of the Stores Board, to place orders with C. A. Parsons and Co. for two 30 MW turbo-alternators (the first to be delivered within four years), and with Babcock and Wilcox Pty., Ltd., for four boiler units at a cost of £1,608,000 (the first boiler to be delivered in 39 months). These two firms are supplying similar plant for the first section of the Tennyson station. Tenders are to be called for the supply, fabrication and erection of the structural frame of the new section and for coal-handling, switchgear and pumping plants. Foundations and river work are estimated to cost £400,000, the building £400,000, and other works £800,000. It is hoped that the two 30 MW turbo-alternators to be installed in the first section of the Tennyson power station, now under construction, will both be operating by 1955, and that the last unit under this new scheme will be in commission by 1957-58.

Atomic Power Problems

Chemists, chemical engineers and metallurgists were rapidly becoming more important than physicists in the development of power plants deriving their energy from nuclear fission, Sir John Cockcroft stated recently when giving a special address at the invitation of the Australian and New Zealand Association for the Advancement of Science, in the Great Hall at Sydney University. The reason for this evolution, he said, was that, although many problems remained for the physicist to solve, the most immediately important, in so far as the industrial application of nuclear fission was concerned, was how to transmit the heat generated efficiently to the power station, which would still be of the orthodox type. Any comparison of the relative costs of power derived from coal or from an atomic pile depended on the prevailing availability of the fuels concerned. It was clear that Britain would run short of coal within a measurable time, for by 1960 she would require 13 million tons for electricity alone. Even countries such as Sweden, which had the advantage of water power, would be looking for alternative sources within 30 years. In those countries not rich in normal fuels, atom plants obviously would be valuable, he added.

Brighter Victoria

For the first time since 1946, Victoria, Australia, is free from all restrictions on the use of electricity. The end of the ban was announced a few days ago by Mr. R. A. Hunt, chairman of the State Electricity Commission of Victoria. Factors which enabled the commission to end restrictions were: (a) the approach of spring, with lengthening daylight hours; (b) an adequate supply of fuel at steam power stations; (c) excellent power output from the commission's hydro-electric power stations; and (d) the prospect of a new power generator starting up at the Richmond power station within the next few days. Mr. Hunt said the only ban now in force in Victoria was that preventing the installation of new night-rate hot water services. This was expected to remain for at least another year.

Plant for Tasmania

The first shipment of turbine parts for Tungatinah power station, for the Hydro-Electric Commission of Tasmania, has arrived at Hobart from England. The Hydro-Electric Commissioner, Mr. Knight, said five turbines were to be installed in the power station, each of 35,000 h.p. capacity. There had been delay in the manufacture of the alternators and the first of these would not be ready for shipment from England until December, he added. In the meantime, erection of the turbines in the power station would proceed.

A Dollar Loan

The dollar allocation for electric power plant under the latest $50 million loan to Australia from the International Bank totalled $4 million, the Treasurer, Sir Arthur Fadden, told the Federal House of Representatives recently. Sir Arthur was introducing a Bill to give effect to the loan agreement. The $4 million is to be used to import materials and equipment for power plants, substations and distribution systems, and also tractors and earth-moving equipment for hydro-electric works. "By enabling Australia to obtain from America additional supplies of those types of equipment which could not be procured elsewhere, the loan must be justified many times over by its ultimate results," Sir Arthur maintained.

Saskatchewan Projects

Engineering reports now before the Royal Commission investigating the feasibility of the proposed South Saskatchewan river dam project indicate that numerous development possibilities exist for the river basin and that sufficient water is available for a major proportion of them. One major proposal is the Red Deer river project in Alberta. Red Deer water alone will only irrigate 300,000 acres and produce five million kWh of electricity annually or alternatively irrigate 100,000 acres and produce 35 million kWh a year. Diversions of water from other streams could increase this capacity. The report adds that to make a recommendation for

an overall water plan now, without an exhaustive study of all phases of all the problems involved, would be unsound and might lead to economic waste. Much additional fundamental data is needed.

Power Licence

Three Saskatchewan cities—Prince Albert, Saskatoon and Swift Current—are anxiously awaiting the year 1954. At that time the Saskatchewan Power Corporation's contract with them is due to expire, and they will have the opportunity to buy back the power plants situated within their boundaries. Saskatoon already owns the distribution side of the plant there but in Prince Albert and Swift Current, the entire plant is run by the power corporation.

Alternative For Manitoba

A hydro-electric development programme which would produce 75% more power than a scheme now planned at McArthur Falls on the Winnipeg river and would cost only 10% more has been placed before Manitoba government officials. The plan calls for abandonment of the McArthur Falls project in favour of enlarging an existing development at Great Falls, seven miles downstream. The latter plant is operated by the Winnipeg Electric Co., Ltd., and Mr. K. C. Fergusson, superintendent of water power to that company, recently outlined this latest plan to government officials. Under the plan, the installed capacity of Great Falls would be increased by 129,500 horsepower at a cost of $25,500,000 compared with an estimated 74,000 horsepower at McArthur Falls costing $22,000,000.

Canada's Output

Output of electric energy by central electric stations in Canada rose 6% in June over the same month last year, according to figures compiled by the Dominion Bureau of Statistics. With increases in each month from January to June, the cumulative total for the first half of this year was 7% above that for last year. The month's output amounted to 4,986·3 million kWh as compared with 4,708·9 million kWh in June last year. In the half year, 30,807·9 million kWh were produced as against 28,814·5 million in the similar period of 1951.

Investigations

The appointment of a firm of electrical engineers to make a complete survey of Orillia's power supply, potential and needs, is expected to be made at an early meeting of the Water, Light and Power Commission as the result of a decision at last month's meeting of the Commission. All the members of that body endorsed a motion calling for the appointment of a neutral impartial firm to obtain all the available information and facts about Orillia's power prior to the holding of a public vote on whether the town should develop a second plant at Minden or become a hydro-participating municipality. Some time ago the Commission instructed their engineer, Mr. L. G. McNeice, to make a survey and report on the cost of developing a second plant at Minden. This report will shortly be ready.

Pine Falls

By the middle of this month it is expected that the Pine Falls hydro-electric plant, Manitoba, will be in full production when the last of six 19,000 h.p. generating sets is put into operation. It is hoped that this will solve Manitoba's power problem for a short while at least.

French Scheme

Electricité de France has announced that a new hydro-electric scheme is to be constructed at Grangent on the River Loire, about 15 kilometres from St. Etienne. The scheme involves the construction of an arched dam about 200 metres in length and 55 metres high, and a diversion tunnel 108 metres long. The power station will have an installed capacity of 32,400 kW, and is expected to generate 108,500,000 units annually.

Equipment Manufacture

The Government of Pakistan has sanctioned construction of a posts and telegraph equipment manufacturing factory in the N.W. Frontier province, at an estimated cost of Rs. 60 lakhs, we learn. The factory will be located at Haripur in the Hazara district. The Czechoslovakian manufacturing concern of "Semig" has been entrusted with the task of providing and installing the necessary equipment for the factory, and also the training of Pakistan technical personnel.

Rural Scheme

The first rural electrification scheme in Madhya Pradesh was switched on recently at Mohapa village, 24 miles from Nagpur. The distribution system at Mohapa, nursery scheme of the Ikhapardkheda central thermal station, is mainly intended to supply power for irrigating 4,100 acres of land in the surrounding villages.

Geothermal Power

The Geothermal Steam Bill, which vests in the Crown the sole right to generate electric power from geothermal steam unless a licence is granted to a private applicant by the Governor-General, has been approved in the New Zealand Parliament. Mr. W. S. Goosman, Minister of Works, is very enthusiastic at the future prospects of geothermal power, and the accelerated development scheme is now under way at Wairakei. Here, 14 bores have already been drilled, and present plans are to drill bores of 500 ft to 1,000 ft to a known horizon of steam. These are to be utilised to operate an experimental 20,000 kW plant which the State proposes to build at a probable cost of £1,000,000. Mr. Goosman has said that at Wairakei a much bigger field can be exploited than at Lardarello, in Southern Italy, where 315,000 kW is now being generated.

PERSONALITIES

IN THE INDUSTRY

Mr. R. A. S. Richardson has been appointed technical sales representative of M.T.E. Control Gear Ltd. for southern England, including Greater London. Mr. Richardson has specialised in the field of electrical control equipment for a considerable period of his career. In recent years his design and liaison work in connection with specialised automatic controls for large-scale defence projects has resulted in his becoming well known in many widely differing branches of industry. After war service he joined the sales staff of the British Thermostat Co. as a switchgear engineer, and later held an executive position on the engineering staff of Dewhurst and Partners.

Mr. R. A. S. Richardson

Mr. B. W. S. Challans, B.Sc.(Eng.), D.I.C., M.I.E.E., who has been in charge of the B.S.I./C.S.A. Approvals Division of the British Standards Institution, has now joined the staff of the Approvals Laboratories of the Canadian Standards Association. After a short period in Canada he will return to London as European engineer of the C.S.A. and his address will be c/o the British Standards Institution. Mr. Challans was with the Admiralty during the war, and is a past Chairman of the Southern Centre of the I.E.E.

A party of electrical engineers from Belgium, accompanied by officials of the English Electric Co., recently visited the new Westwood (Wigan) generating station of the North Western Division of the B.E.A., where they were particularly interested in the switchgear and discussed the difficulty of locating faults on ring mains. Our accompanying photograph, taken on the occasion, shows left to right, Messrs. **W. A. Snodgrass** (E. E. Co. Liverpool), **G. T. Delamore** (station superintendent), **T. Stockwell** (No. 2 sub-division electrical engineer), **M. Barman** (of Antwerp), **A. Vassilissin** (E. E. Co. London), **M. C. Iesceux** (mains engineer, City of Brussels) and **M. M. Van Mossevelde** (City of Brussels distribution engineer).

Discussing matters at Westwood with the Belgian engineers

To commemorate the recent completion of 25 years' service with Bakelite Ltd., **Mr. G. Dring,** M.A., B.Sc., F.R.I.C., M.I.Chem.E., F.P.I., research and development director of the company, was entertained at a private lunch attended by senior executives of the concern, when he was presented by the chairman and managing director, **Mr. H. V. Potter,** with a gold watch suitably engraved. Mr. Dring's first experience in the plastics industry was in 1921, when, after taking an Honours Degree in Chemistry at Trinity College, Cambridge, he joined the Damard Lacquer Co. as research chemist. Two years later he went to Manchester with the Bradford Dyers' Association, but returned to the plastics industry in 1927 following the amalgamation of the Damard Lacquer Co. and Mouldensite Ltd., and the formation of Bakelite Ltd. He was works manager at Darley Dale until 1932, and when the new factory opened at Tyseley, he moved to Birmingham in charge of the Development Department. He was made a director of the company in 1942, and still holds today the post of research and development director. He is vice-president of the Plastics Institute and chairman of the Plastics Industry Committee of the B.S.I., and has held many other official posts in scientific and technical societies connected with the plastics industry.

Mr. G. Dring

Formerly well known in the contracting industry in the Croydon and Sanderstead district of Surrey, **Mr. Quintin A. Gosling** has taken over the management of a new branch opened by Giles (Electrical Engineers) Ltd., at 14 Hanover Square, Leeds 3.

Mr. N. C. Robertson, M.B.E., ASSOC.I.E.E., F.R.S.A., Director-General Electronics Production, Ministry of Supply, left England by air on Tuesday last for a four-weeks visit to the United States and Canada. He is to exchange information on electronic manufacturing techniques and discuss standardisation of equipment between Britain, Canada and the U.S. During his journey he will visit Government establishments and industrial plants engaged on electronics production for the United States and Canadian forces. His route takes him from Montreal through Toronto, Winnipeg, Calgary, Vancouver, San Francisco, Kansas City, Washington, New York and Boston before his expected return to Britain on October 8.

We learn of the appointment of **Mr. Roy C. Orford,** M.SC., C.P.A., A.M.I.E.E., as patents manager to Power Jets (Research and Development) Ltd. A Cornishman, Mr. Orford was educated at Truro School and the University of Bristol. During the early war period he worked in the Transmission Department of the General Electric Co., Coventry, and later served in the R.N.V.R. as an air electrical officer. After the war he became a development engineer with Waymouth Gauges and Instruments Ltd., and in 1947 joined the Patent Department of Standard Telephones and Cables Ltd. He joined Power Jets in March, 1951

Ald. Wright Robinson, J.P., M.A., is to retire next month from the chairmanship of the North Western Electricity Consultative Council, a position he has held since the formation of the Council four years ago.

After faithful and wholehearted service with the Sloan Electrical Co. for over 52 years, **Mr. Alfred Brown,** the company's senior sales representative, retired a few days ago. During that long period with the firm he has made a host of friends within the industry, and we feel sure that all will join in wishing him many years of good health in which to enjoy the leisure he has so deservedly earned. For Sloan Electrical, the association with Mr. Brown is to be continued in the person of his son, **Mr. Stewart A. A. Brown,** who has been appointed sales representative for Essex, and will operate from the company's Leyton depot at 6 Albany Road, E.10.

Mr. Alfred Brown

Mr. Stewart A. A. Brown

The British Standards Institution announce the appointment of **Mr. T. R. B. Sanders,** C.B., as engineering adviser to the Institution. A professional engineer of distinction, Mr. Sanders held a number of key posts at the Ministry of Supply from 1944 to 1951, and was concerned with the technical development of a wide range of Service equipment. While in charge of the Ministry's standardisation programme, he came into close contact with the B.S.I. and was for some years a member of the Institution's Engineering Divisional Council. In 1948 he was a signatory, on behalf of the British Government, of the "Declaration of Accord," by which the American-British-Canadian unified screw thread was established. Mr. Sanders will give first priority in his new appointment to furthering the British end of the current A.B.C. programme for the unification of engineering standards. Subsequently, and within the limits of the time he has available, his interest will extend to the whole of B.S.I.'s work in the engineering field. He will be concerned both in the preparation of standards and in furthering their use in industry.

Mr. T. R. B. Sanders

Among a number of new appointments announced by the State Electricity Commission of Victoria, Australia, we note that **Mr. W. W. Miller,** B.E.E., DIP.E.E. and MECH. E., A.M.I.E.(AUST.), has been nominated tests engineer in the Electrical Branch of the Commission's Design and Construction Department. Also **Mr. J. F. Hughes,** B.E.E., A.M.I.E.(AUST.), is now protection and communications engineer in that same branch. Mr. Miller started with the Commission in 1924. For several months between 1946 and 1947 he acted as test and protection engineer, and since July, 1949, he has been laboratory engineer of the Tests and Protection Section. Mr. Hughes joined the Commission in 1936 in the Substation Engineers' section, but three years later transferred to the Tests and Protection Section. After war service he was appointed protection superintendent in 1945, and has been relay and communications engineer since July, 1949.

Nettle Accessories Ltd. have appointed **Mr. E. Edwards** as their representative to cover Mid-Sussex, East Sussex and South West Kent, the southern portion of the Kent area of the South Eastern Electricity Board and Nos. 3 and 4 sub-areas of the Southern Electricity Board. Mr. Edwards resides in Brighton, his telephone number being Brighton 20115.

Mr. W. E. S. Walker, machine shop foreman with the Edison Swan Electric Co., Sunderland,

has retired after 26 years with the company, and has been presented with a gold watch by the employees and a cheque by the firm.

Mr. S. Luxmore has been appointed an electrical inspector of mines and quarries.

OBITUARY

Mr. W. E. Greenwood, director of Mather and Platt, Ltd., died on September 4, aged 50.

Mr. J. A. B. Horsley, O.B.E., M.I.E.E., formerly H.M. electrical inspector of mines, died on September 7, aged 78. Mr. Horsley was the electrical inspector of mines from 1919 until November, 1939, when, although passing the usual age limit for retirement from the Civil Service, continued, at the request of the Secretary for Mines, to undertake special duties for the Mines Department during the war. He eventually retired at the end of last March. He started his career as an apprentice with the General Electric Co., and after four years as a mining electrical engineer with the Ferreira gold mines, Transvaal, South Africa, joined Robert Hammond, the consulting engineer, in 1899. From 1902 to 1916 he was electrical engineer to the Tonbridge U.D.C. and to the Harrow Electric Light and Power Co., and after service in the R.N.V.R. was appointed H.M. electrical inspector of mines in 1919.

NEW LITERATURE

Practical Electrician's Pocket Book

edited by R. C. Norris

CHANGES for the 55th appearance of this popular volume have once more concentrated on the revision and extension of existing material. There are some new chapters in evidence, however, notably helpful discussions of switches and control circuits and of time switches. Notes on power factor have been added to help the works electrician, while for the domestic installation wiremen there is a check list of points to consider when asked to advise on lighting in the home. An absentee this year which some will regret is the list of mains voltages. One thing remains above all, however—excellent value for the money. Published by Electrical and Radio Trading, 551 pages, 5 in. by 4 in. Price 5s.

Elementary Mathematics

by Lewis W. Phillips, M.I.E.E., F.Inst.P.

IT is perhaps a regrettable thing that the word "elementary" is applied to mathematical textbooks which vary in difficulty from school examination standards to fairly advanced university teaching. In this volume, the word elementary is used in its proper sense of introducing first principles. Further, attention has been focused on the practical everyday use of mathematics without delving too deeply into theoretical proofs. The book is not, therefore, to be regarded as a complete study of first principles, but rather as a revision textbook of those parts of basic mathematics which are liable to cause difficulty.

The exposition is clear and well written, and the examples to be worked are practical and realistic. Subjects covered include elementary arithmetic, mensuration of plane figures and solids, simple algebra, logarithms, graphs and trigonometry. The standard is that of the syllabus of the Royal Society of Arts examination (grouped courses) in elementary mathematics, but is also well suited for initial work at night schools and technical colleges. Published by Macdonald and Co., 16 Maddox St., London W.1, 339 pp., 5½ in. by 8½ in. Price 12s. 6d.

Fluorescent Lighting

edited by C. Zwikker.

A LARGE number of books dealing with fluorescent lighting has been published in the past few years. In most of these the emphasis has been placed on some particular facet of the subject. Here, however, written by nine engineers of the Philips organisation at Eindhoven, is a comprehensive work covering both the theoretical and practical aspects of fluorescent lighting in great detail.

Starting with a description of present knowledge on the kindred phenomena of luminescence, fluorescence and phosphorescence, the book continues with details of the composition and preparation of luminescent substances, the colour rendering of lamps, gaseous discharge, lamp construction, lamp types, auxiliaries including circuits, ballasts and starter switches and finally deals with lighting fittings and the fundamentals of lighting technology. The illustrations and diagrams which are lavishly distributed throughout the volume are of a particularly high quality, and there can be no doubt that the book will be of great value to all who are concerned with the application of fluorescent lighting, either from an experimental viewpoint or from the practical installation angle. Distributed in U.K. by the Cleaver Hume Press Ltd., 248 pp., 6 in. by 9 in. Price 35s.

BOOKS RECEIVED

Alternating Current in Telecommunications, by W. T. Palmer. Published by Pitman, 36 pages, 7¼ in. by 4¾ in. Price 4s.

Electricity in the Home, some precautions that should be taken. Issued by the Fire Protection Association, 84 Queen Street, London, E.C.4., 16 pages, 4¾ in. by 3 in. Gratis.

Sappers in the Persian Gulf, by W. H. Adcock. Reminiscences of wartime service on developing water and electricity supplies in the Middle East. Published by Thacker and Co., Bombay, 175 pages, 8½ in. by 5½ in. Price Rs.10-8.

11 SEPTEMBER, 1952

HUNGARY PLANS

Large increase in Electric Power Production

By NEIL STEWART

HUNGARY plans a big increase in electric power output to cope with expanding industrial needs. Electric power output in 1951 was put at 3,060 million kWh. This is already a big increase on the 1938 figure of 1,399 million kWh and the 1949 output of 2,200 million kWh, but it is to be increased to 6,050 million kWh by the end of 1954.

Electric power production in Hungary presents engineers with some difficult problems. Although Hungary is a coal producer, most of this comes from lignite deposits and for firing the fuel demands furnaces of special design. Hydro-electric power capacity is much less great than that in neighbouring Rumania, for example, due to the low head of water on the two main rivers, the Danube and the Tisza.

Nevertheless, the demands of increasing industrial production and the plan to supply electricity to Hungary's 3,400 villages by the end of 1954 mean that a number of thermal and water power generating stations have been built, and others are projected.

Varpalota

The first of these was at Varpalota, east of the Danube, and began operation in December, 1951. This plant will have six generators when completed, and is situated in the Hidegvolgy valley at the foot of the Bakony mountains. Three generators are already in operation.

It needs 5,000 tons of coal a day, and will be connected by a cable conveyor system with the nearby mines. Coal is also coming from a new open-cast deposit at Szentgal. The 57,000 cubic metres of water needed by the plant each day come partly from the Hidegvolgy river and from a 500-metre deep well.

A power cable connects the plant with Budapest, but much of the power will be used locally, particularly in a large plant which will process bauxite from Hungary's ample deposits. Much of the machinery used at Varpalota came from Czechoslovakia, and a large number of Czechoslovak workers and technicians helped to set up the station.

The Inota station at Varpalota

A second important power station is at Kazinbarcika, in Borsod county, in north-east Hungary. Work has been going on here since 1950, and a large part of the construction is already completed. The boilers were scheduled for assembly during August, 1952. Borsod county is now an important industrial area, and near the plant will be situated a large chemical works, coking and coaling plant.

A third large thermal generating station will be built at Mohacs, in southern Hungary, where considerable industrial expansion is planned. A large power station is attached to the big iron and steel works at Sztalinvaros, and is already partly constructed. A power plant will be built at Lovaszi, which will use supplies of natural gas to fire its boilers.

Plans for use of water power are already afoot. In July 1951, a number of technical groups began investigations to choose suitable sites for the construction of small hydro-electric plants. Most of the plants will be built in Transdanubia and in northern Hungary, where there are more suitable rivers.

The technicians will make 250 surveys and plans for the construction of a number of dams and the necessary machinery are already in hand. It is estimated that the small plants will help considerably in the electrification of the villages and will relieve the pressure on thermal generating stations.

But by far the most important hydro-electric station to be completed before the end of 1954 is at Tiszalok, on the river Tisza. It is part of a comprehensive water-control project aimed to direct the flow of the river Tisza, to provide electric power, and water for irrigation and navigation.

The whole scheme provides for three barrages, a 60-mile gravitation canal through the Hortobagy Plain, which will irrigate 750,000 acres of low-lying territory, and will improve communications in an area previously badly served. About 600 miles of waterway will be made navigable for craft up to a thousand tons capacity. The barrage at Tiszalok, in northern Hungary, and the Hortobagy canal are scheduled for completion by the end of 1954.

The barrage, lock and power station at Tiszalok are being built on a cross-cut between two bends in the river. A large Soviet-made walking drag-line excavator has been in action there for some time, and by the end of 1951, 15,000 cubic metres of concrete had been laid. The river will be raised by the barrage.

Twice Present Output

The power station is situated on the east bank of the river, and will generate 54 million kWh annually, or twice the present hydro-electric production of Hungary. Much of the current will go to the growing industrial area around Miskolc. The station will consist of three 15-foot diameter Kaplan turbines, with an intake of 95 cu m/sec. of water.

Three other hydro-electric projects are planned. Further barrages will be on the river Tisza at Tiszabo and at Szeged, near the southern frontiers. It is to be followed by a barrage across the Danube at a point not yet specified, which will be of considerably greater proportions than any of the Tisza projects.

Handbook for Installations

A NEW publication which is of the greatest value to installation engineers and factory maintenance men has recently been issued by the General Electric Co., Ltd., Magnet House, Kingsway, London W.C.2. It is a handsomely bound handbook which combines lists of the whole range of G.E.C. products within the installation field with a varied and valuable quantity of technical information on all aspects of installation technique.

The handbook, which extends to some 800 pages in length, is the direct successor to the 1935 edition of the bound installation equipment catalogue which is still in use in many offices. As its name suggests, it is something more than a catalogue this time, and has been written to give the installation designer all the information he requires for the roughing out and preliminary pricing of a scheme within single covers.

Price change difficulties have been overcome by standardising on a given date for those printed in the book (first quarter of 1951) with the intention of bringing these up to date at yearly intervals, beginning with the first quarter of next year. Some 50,000 copies of the handbook are being printed for circulation in this country and abroad, and the export edition is to have an additional section of about 119 pages covering extra information likely to be required by engineers working at a distance from manufacturers' factories.

A particularly useful feature of the style of presentation adopted is the provision for ready identification of the section required when flicking over the pages of the book. This offers most of the advantages of thumb indexing without its drawbacks. Distribution of the handbook is to be centred in the hands of local representatives in this country and abroad.

BRITISH STANDARDS

Vulcanised Rubber Compounds. *B.S.* 1154:1952. *Price* 2*s.* 6*d.* This standard replaces the war emergency specification published in 1944, and which was based on the earlier Government Department specification T.G.25A. The new standard covers four white compounds and six black compounds, the former being produced from natural rubber and zinc oxide, and the latter from natural rubber, zinc oxide and lamp black. The various compounds are classified according to their hardness. The standard includes skeleton compositions as well as testing requirements, while an appendix includes mixes which give vulcanisates complying with the requirements of the standard.

Synthetic Resin Bonded-Paper Insulating Tubes of Rectangular Cross-Section for Electrical Power Circuits up to 1,000 V. *B.S.* 1885:1952. *Price* 2*s.* 6*d.* Setting out the requirements for s.r. tubes as specified in the heading, this new addition to the published series of standards covering insulating material, is complementary to B.S. 1314:1946 (specification for circular s.r. tubes). Tubes specified herein are for use at voltages up to 1,000 V d.c. or 1,000 V a.c., rms value, at frequencies up to 100 c/s, having internal side dimensions from $\frac{1}{4}$ in. to 6 in. and wall thicknesses between $\frac{1}{32}$ in. and $\frac{1}{8}$ in. Specifying tolerances on these dimensions, in addition to electrical and mechanical properties required of these tubes, the standard is completed with appendices outlining test methods and preparation.

British Standards reviewed above may be obtained at the prices stated from the Sales Branch, British Standard Institution, 24 Victoria Street, London S.W.1.

The BUYER'S *Column*

Chilton's Free Offer to Retailers

EACH of 20,000 retailers of the electric dry shavers produced by CHILTON ELECTRIC PRODUCTS, LTD., Hungerford, Berks, will during this week receive from the company a circular letter giving details of an interesting free offer.

The company offer a free gift of a transformer adaptor, value 26s. 6d., with each order for one Buk dry shaver at £4 15s. 1d. including tax and two KUB shavers at £3 7s. 4d., together with valuable display material.

This is being done to publicise the Chilton Transformer adaptor which has proved an invaluable asset to those who frequently travel and encounter many different supply voltages.

2-Amp 3-Pin Weatherproof Coupler

THE range produced by NETTLE ACCESSORIES LTD., Harper Road, Wythenshawe, Manchester, has been extended by the addition of a 2-amp three-pin weatherproof cable coupler, Ref. No. RC 00031, similar to the 5-amp three-pin coupler which was noted in an earlier issue of the ELECTRICAL TIMES. This coupler will be found

Nettle's latest, 2-amp weatherproof coupler

useful in many instances for light mobile domestic appliances, such as lawn mowers and hedge trimmers.

The range of weatherproof couplers will soon include 15-amp three-pin and four-pin types.

Ekco's Four New Starter Switches

RECENT announcement by E. K. COLE, LTD., Southend-on-Sea, Essex, concerns the introduction as from the beginning of this month of four new types of starter switches.

These have many distinctive features. The contact pins are solderless as well as solid, thus ensuring easy and accurate entry into the sockets. The cannisters which are extra strong are precision manufactured, and filled with thicker bases. The improved vacuum technique ensures a longer switch life.

New Berry Introductions

MENTION of two new models added to the range of electric heaters by BERRY'S ELECTRIC, LTD., Touchbutton House, Newman Street, London W.1, is most comforting during the present (at time of going to press) cold snap.

The first is No. 606, a 2-kW panel fire for outset mounting, finished in stove enamelled cream and fitted with two control switches. It is priced £5 10s. plus p. tax. Dimensions : 19½ in. wide by 12 in. by 4½ in. The second, which we have illustrated, is No. 612 2-kW illuminated radiator. A portable fire with warm silver finish, fitted with two control switches, this model is unusual in that it is fitted with an illuminated glass panel below the heating elements. Price is £6 7s. 6d. list plus purchase tax.

Berry's 612 is warming both physically and mentally

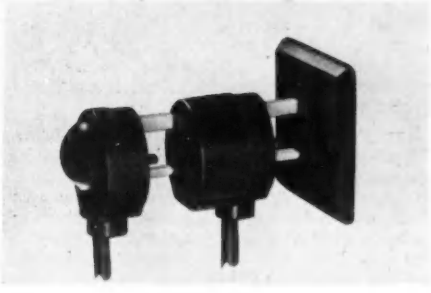
Ediswan Clix Plug Adaptor

JUST introduced by THE EDISON SWAN ELECTRIC CO., LTD., 155 Charing Cross Road, London W.C.2, is a new Ediswan Clix 13-amp fused and shuttered plug adaptor.

Used in place of the normal multi-way adaptor this unit combines the operations of plug and adaptor. The plug adaptor is wired to one appliance in place of a normal plug; the second appliance, or a further adaptor, can then be fed from the adaptor outlet. There are no worries regarding the position of the auxiliary outlets, and there are no loose adaptors to become lost or mislaid.

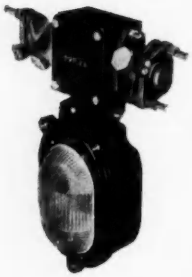
The unit fits any standard 13-amp socket to B.S. 1363. The Clix re-fusing device, as used in the Clix 13-amp plug, is incorporated and the adaptor outlet is shuttered. List price is 7s. each, brown; 8s. each, ivory.

The Ediswan Clix 13-amp plug adaptor helps to solve outlet point problems



Simplex Weatherproof Lighting

AN addition to the non-flameproof underground lighting system marketed by SIMPLEX ELECTRIC CO., LTD., Broadwell, Oldbury, Birmingham, is the new weatherproof 40-60 W Prismatic Bulkhead lantern unit which we have illustrated.



Weatherproof and sound—it's Simplex

This addition is designed to be used in conjunction with the connection boxes and glands which were earlier additions to the system. Intention of the firm in introducing this unit was to provide a weatherproof prismatic bulkhead fitting with the minimum amount of projection and having an assymetric light distribution. It is particularly suitable in use in mine roadways where headroom is limited, and it is attached to either the 3-way or 4-way connection boxes of the system mentioned above. The back of the unit is tapped $\frac{3}{8}$ in. Whitworth, as is the connection box and both can be suspended. A suspension eye (Cat. F7150) is suitable for this purpose.

Price Reductions

AN announcement by the BRITISH ALUMINIUM CO., LTD., St. James's Square, London S.W.1, concerns price reductions, amounting to 2d. a pound or nearly 8% for bulk quantities, for the special range of thin-gauge sheet and coiled strip for boxmaking and capping purposes.

These reductions came into effect on Sept. 1.

The new rolling equipment installed at the Falkirk mills also makes possible the inclusion of a stronger alloy for boxmaking at prices previously charged for pure aluminium and $1\frac{1}{4}$% manganese alloy.

R.E.A.L. Plinth Lights Back Again

AFTER a break of many months in the production of the range of Plinth Lights, ROWLANDS ELECTRICAL ACCESSORIES, LTD., Real Works, Hockley Hill, Birmingham 18, have resumed manufacture.

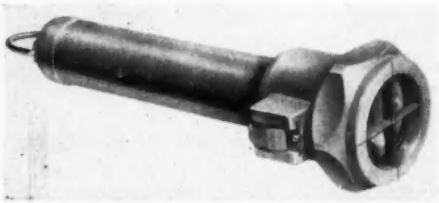
When first marketed, the Plinth light was backed up by a national publicity campaign, and large sales resulted. Unfortunately, the firm were unable to obtain certain raw materials and found it necessary to cease production.

Readers will find the booklet "New Light on Flora," R.E.A.L.'s descriptive booklet, most amusing. Its style, although light-hearted, is most suitable for presenting the advantages of the Plinth light. Copies are again available. Prices of the lights are: List No. 5000 R.E.A.L. Plinth light, 40s. List No. 5002 Junior Plinth light, 30s. List No. 5004 Hotel Plinth light, 50s.

New Flameproof Torch

WEATHERPROOF and flameproof, a battery torch made by THE GENERAL ELECTRIC CO., LTD., has been designed to operate with safety in mines, cellulose-spraying plants, garages, petrol establishments, gasworks, and oil tankers. It carries Ministry of Fuel and Power and Home Office Certificates for use in situations where methane, petroleum vapour, acetone or town gas may be present.

The case is strongly made of cast aluminium alloy, the interior being treated with an anti-corrosive preparation. Armour plate glass forms



The construction of the torch is shown here

the front lens, which is cemented in a screwed ring (eliminating rubber gaskets) and is additionally protected by two stainless steel blades. The long-wearing labyrinth switch affords easy action with absolute safety. A feature particularly useful in marine work is the hexagonal head, which prevents rolling when the torch is laid upon its side. This head is secured by a latch, which in turn can be locked against unauthorised interference by a lead seal or plug. A suspending ring is fitted to the tail of the case.

The 3·5 V ·3 amp. Osram bulb is carried in a separate holder with a spring contact that obviates any crushing of the contact pip against the battery. This bulb-holder can be adjusted in relation to the reflector to give either a flood or spot light.

TRADE PUBLICATIONS

FLUORESCENT TUBES.—"The facts and figures behind the outstanding performance of Atlas double-life fluorescent tubes" are stated in a folder of that name, issued by Thorn Electrical Industries, Ltd., 105 Judd Street, W.C.1.

LAMPS.—Osram's lighting catalogue has appeared in a new form. Part one, "Lamps and Tubes," is now available from the General Electric Co., Ltd., Magnet House, Kingsway, W.C.2. Concise information is presented in a readable, pleasant manner.

CERAMICS AND POTTERY.—"Shaping the needs of Industry" is a most appropriate title for the brochure issued by Doulton and Co., Ltd., Albert Embankment, London S.E.1, describing the work and products of this well-known firm. Sanitary ware, laboratory equipment, industrial, acid and fume-resistant fittings, electrical insulators and inn signs are but few of the products.

The WEEK in NEWS

Past and Present in Productivity

Final Report of Anglo-American Council

PLANS for the future are featured prominently in the Final Report of the Anglo-American Council on Productivity. This apparent paradox is explained by the intention of the U.K. section of the Council to continue as a British Productivity Council, whose function will be to take all possible steps to encourage the improvement of productivity. An early move will be the publication of a book setting out the chief factors affecting productivity.

Evaluating the results of the Council's work since its formation four years ago, the report suggests that one of the most important benefits it has brought about is the "improvement in the climate of opinion about productivity."

Altogether 66 teams were sent to the United States under the Council's arrangements, 47 of them being concerned with individual industries and the remainder with specialist subjects. A number of these teams have still to publish their reports.

It is emphasised that the team visits were not an end in themselves. The eventual requirement is that they should lead to action at plant level. By spreading knowledge of American methods, they have contributed to this aim. In the longer run, however, continuing increases in productivity will depend upon a high level of investment in productive plant and power, better production management, and the pressure of competition. Other factors are adequate statistical data on production performances, and co-operative action based upon a broader appreciation and acknowledgment of the intimate relationship between productivity and the standard of living.

Total cost of the programme has been approximately £844,500. Of U.K. expenses, almost £180,000 came from a Treasury grant-in-aid and from contributions by British members, a further £146,000 from British industry.

400 DELEGATES AT TECHNICAL CONFERENCE

THIS year's International Electro-Technical Conference opened at Schereningen, Holland, last week. Seventeen of the 29 member nations are represented by some 400 delegates who have before them a comprehensive programme which is due to be completed this coming Saturday. The majority of European countries, west of the Iron Curtain, are taking part, including Britain, and have been joined by delegates from the U.S. and India.

Nineteen committees are scheduled to hold meetings, and there is a formidable list of persons from this country taking part. The total number from England is about 60.

FURTHER DETAILS OF LEAD TRADING

AS previously recorded in these columns the London Metal Exchange is to resume lead trading on October 1. Further details concerning future dealings have now been made known. Trading is to take place in four settlement months beginning with October. Metal will be deliverable during the following month. To cover any immediate requirements, dealing will also be allowed in prompt metal, entailing delivery within five days if sold ex-ship, or three days if sold ex-warehouse.

The B.o.T. has also announced its arrangements for the future import and export of lead. Members of the Exchange participating in the Bank of England Exchange Control Scheme will be granted open individual licences valid for imports from any source. Consumers wishing to import large quantities regularly otherwise than through the Exchange will be granted open individual licences. Returns, giving full details of such imports, will have to be made monthly. Other traders should make application in respect of each transaction to the Import Licensing Branch, Romney House, Tufton Street, S.W.1.

The First Half-Century

To waste energy and destroy the road surface by carrying heavy goods in road wagons when there are the tramway rails lying to hand exactly suited for the work seems an absurdity. Nevertheless, it is one that prevails almost universally. In Germany, however, where hardly anything at all has been left untried which could promote the commercial development of the country, there are several instances to be found in the various towns in Alsace, Bavaria, Westphalia, Saxony and Brandenburg, where tramway systems have been utilised more or less extensively for the carriage of goods. At Mulhausen the tramways have been brought into connexion with a light railway system, and as many as twenty-five (short) trains per day go over them.—*From our issue of September* 11, 1902.

Lectures on Heat and Power

SENIOR works and plant engineers interested in fuel economy in industry will have an opportunity this winter of studying the subject in a series of 19 lectures which are to be given at the University of Nottingham, organised by a committee under the chairmanship of Mr. E. G. Phillips, O.B.E., M.I.Mech.E., M.I.E.E., the course is designed to promote the application of works engineering practice over a wide field of industries. Subjects to be covered include all types of prime mover, boilers and accessories, the distribution and use of process steam, and instrumentation. Further details of the course may be obtained from the Secretary, Heat and Power Course, Dept. of Civil and Mechanical Engineering, University of Nottingham.

GOLDEN ANNIVERSARY

A BOOKLET has just been published giving a brief history of Rist's Wires and Cables, Ltd., since its formation in 1902. Progress made since the early days in Elthorne Rd., Upper Holloway of Prested Miners' Gas Indicating Electric Lamps, Ltd., makes interesting reading. The main celebration of this event comprises a variety concert today (Thursday) at which the vast majority of the firm's 2,000 employees are expected to attend, and long-service awards will be presented.

OFFICIAL PUBLICATIONS

ANGLO-AMERICAN COUNCIL ON PRODUCTIVITY.
The Final Report. A.A.C.P., 21 Tothill Street, London S.W.1. Price 3s. 6d. (*See page 467*).

BRITISH STANDARDS.
Amendment slips; PD1428 to B.S.98, *Dimensions of screw lampcaps and lampholders (Edison type);* PD1448 to B.S.787, *Flameproof airbreak electrically operated gate-end boxes;* PD1454 to B.S. 161, *Tungsten filament general service lamps:* and PD1444 to C.P. 343 *Centralised domestic hot-water supply.*

MINISTRY OF FUEL AND POWER.
Report of the Committee on National Policy for the Use of Fuel and Power Resources. H.M.S.O. (*See page 438*)

Fluorescent fittings installed in a candle-making factory

Conference on Ash and Clinker

TO be held by the Institute of Fuel, on Tuesday and Wednesday, October 28 and 29, is a conference entitled "A Special Study of Ash and Clinker in Industry." This conference is being held as it is thought that there is not a sufficient amount of general knowledge available in published form to enable industry to appreciate the effect of ash in the efficient utilisation of low-grade coals.

The papers to be presented cover the subject comprehensively, and will, after the conference, be published as a reference work. They cover the origins and nature of ash, handling and disposal, boiler design and the effects of ash on efficiency, atmospheric pollution, gas production and problems of the coal-fired gas turbine.

All sessions will be held in the lecture hall of the Institution of Mechanical Engineers, Storey's Gate, London S.W.1, and there will be two sessions each day, from 10 a.m. to 12.30 p.m. and in the afternoon from 2 p.m. to 4.30 p.m.

The conference fee of £1 1s. to members (£1 11s. 6d. to non-members) covers membership of the conference, a set of preprints and one copy of the final report of the proceedings.

Full details may be obtained from the Institute of Fuel, 18 Devonshire Street, Portland Place, London W.1.

Lighting Scheme in a Candle Works

A SOURCE of illumination more efficient than the lighting product being manufactured was necessary at the Belmont works, Battersea, of Price's Patent Candle Co., Ltd., where fluorescent fittings supplied by Benjamin Electric, Ltd., were employed. The photograph above shows the wick-plaiting department. The fluorescent fittings used are the company's 80-W type FF Flurolier reflectors, installed on continuous channelling. This continuous wiring channel without reflectors abutting each other was accomplished by means of Benjamin Intermediate Channels.

PREPARATIONS FOR CORONATION B. I. F.

THE British Industries Fair attracts a great deal of attention throughout the world in normal years but the organisers are justifiably hoping for a bumper year in 1953 when the Coronation will be added to annual festivities.

This month a world-wide promotional campaign is being launched. One of the first stages will involve Press advertising in Australia and New Zealand. Special plans for advertising in the U.S. and Canada are being prepared and the services of local agents will again be utilised.

BOARD REPLIES TO CRITICS ON ELECTRICITY COSTS

THE question of the cost of electricity to industry on Merseyside was raised in Parliament just before the summer recess. It was alleged then that some concerns were leaving the area because of electricity charges and that others were being deterred from seeking sites for the same reason. The Merseyside and N. Wales Electricity Board has recently refuted those allegations. Mr. W. Gilchrist, chief commercial officer, has stated that there was no evidence to support either contention, nor was there any justification for the complaint that electricity was more expensive on Merseyside than elsewhere.

Challenged by Liverpool's Street Lighting Committee over the £20,000 a year being charged for the installation of service-line charges, the Board stated that the Committee was only being asked to pay for the service, which it had not done hitherto. The charge of about £10 per service would be lower at contract prices where a number of lamps were involved.

T.V. Makes Its Bow in Canada

CANADA'S first television station, CBFT (Montreal), was officially opened last Saturday, and was closely followed by the inauguration of a second network, CBLT (Toronto), on Monday. These two stations are the first in a planned nation-wide service envisaged by the Canadian Broadcasting Corporation, which will comprise similar stations at Ottawa, Vancouver, Winnipeg, Quebec, Halifax and Windsor (Ontario). The first-named is expected to be completed next year and will be linked to Montreal by a micro-wave radio relay.

Both cities have been supplied with two studios and their control rooms, a master control room and film-projector room. In the larger studios are three Image Orthicon camera chains, and in the control rooms all vision mixing, distribution amplification, power supply and similar equipment. The master control rooms have studio picture monitors, waveform monitors and switching equipment.

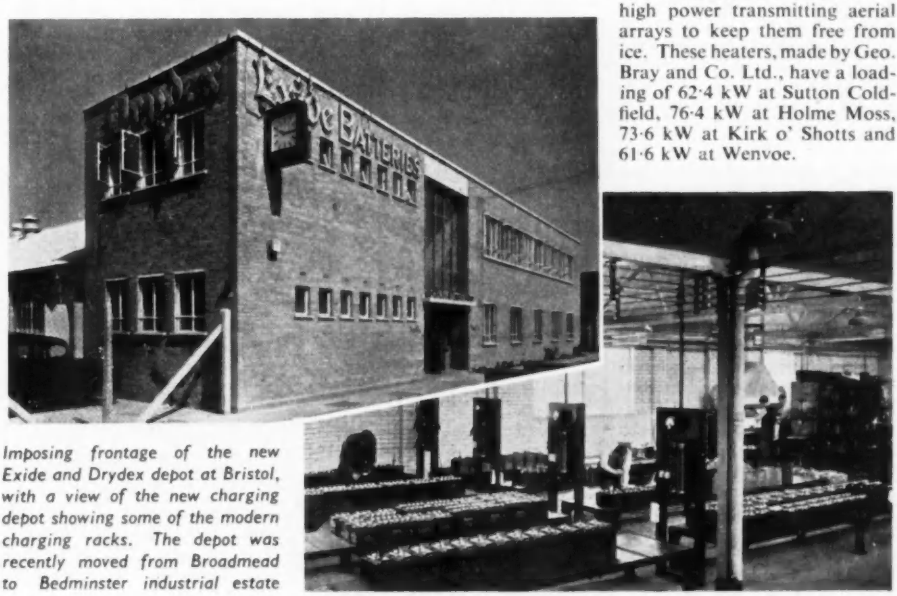
It will be recalled that an order for equipment worth some $300,000 was placed with Marconi's Wireless Telegraph Co. in May, 1950, and that in the following month came a $180,000 order for two outside broadcasting vans. The vans were specially designed, streamlined, and contain all necessary equipment.

Airfield Strike Ends

THE strike of nearly 100 electricians employed by the Newmarket firm of E. Dyne and Co., who were engaged on maintenance work at nine airfields in East Anglia (to which we referred on July 24), has now ended. The firm and officials of the Electrical Trades Union have agreed to negotiate, we learn. The dispute developed following the dismissal of five men, alleged to be redundant. The strike had the backing of the National Executive of the E.T.U.

DE-ICING DIPOLES

THE effects of ice formation on the dipoles of television transmitters can prove disastrous to picture quality. For that reason, electric heaters have been installed on the four main B.B.C. high power transmitting aerial arrays to keep them free from ice. These heaters, made by Geo. Bray and Co. Ltd., have a loading of 62·4 kW at Sutton Coldfield, 76·4 kW at Holme Moss, 73·6 kW at Kirk o' Shotts and 61·6 kW at Wenvoe.



Imposing frontage of the new Exide and Drydex depot at Bristol, with a view of the new charging depot showing some of the modern charging racks. The depot was recently moved from Broadmead to Bedminster industrial estate

This years' illuminations at Blackpool were officially switched on by Miss Valerie Hobson on Thursday of last week. Our illustration shows part of the 1953 display—Talbot Square, where 20,000 people watched the inauguration ceremony. An ambitious tableau is the Elizabethan set depicting both Queen Elizabeth I and the present Queen with members of the Royal family

Electrical Courses in Manchester

A MOST comprehensive range of post advanced lectures in electrical and mechanical engineering has been arranged for the 1952-53 session by the Manchester Advisory Council for Further Education. The courses, comprising one lecture a week in each case, will be held at two centres, namely, the Royal Technical College, Salford, and the College of Technology, Manchester. Those at the former college include "Electrical Safety in Industry" on Thursdays, beginning on October 9 for five weeks, "Electrical Process-Heating" on Wednesdays starting on October 8 for ten weeks, and "Planning of Electricity Distribution Systems" also on Wednesdays beginning on January 14 for ten weeks. The fee for each of the above courses will be one guinea.

Among the courses at the College of Technology are those on "Application of Electrical Technique to Mechanical Problems" starting on January 12, "Characteristics, Design and Construction of Large Electrical Machines" starting on January 16, "Design and Use of Model Networks for Power System Studies" opening on January 21, and "Protective Gear for Power Systems" beginning on November 4. Fee for each of the above except the last will be £1 15s. Further particulars of these courses may be obtained from the Principal of the appropriate college.

Relaxation Treatment

THE Borough of West Ham (London) has arranged a course of six lectures on "Relaxation Treatment of Electrical Problems" at the College of Technology. The lecturer will be Mr. G. F. Freeman, and the talks will be given on consecutive Thursdays, starting on October 16. We understand that the course will be suitable for graduates or students of similar background. Fee for the course is £1 1s.

Power Barge to be Launched on Monday

THE self-contained diesel-electric power barge being built in this country for use in Venezuela by the Shell Petroleum Co., Ltd., is scheduled to be launched on the Clyde next Monday. Details of this floating power station were given in our April 17 issue. Its purpose will be to provide power for drilling operations in the oilfield beneath Lake Maracaibo and is to be used in conjunction with a drilling platform sunk on to the bed of the lake. Electrical machinery aboard has been supplied by Metropolitan-Vickers Electrical Export Co., Ltd., but none will be used for its own propulsion, the barge being towed across the Atlantic by a tug. She is 158 ft long, 80 ft in beam and will have displacement of about 2,545 tons.

E.A.W. NEWS

Exam. Results

THE results of three examinations staged by E.A.W. in May and June of this year have just been announced. The first in chronological order was the third Examination for Electrical Sales Teachers, in which 23 candidates qualified for the certificate, three gaining distinction. A total of 98 sales teachers have now obtained the certificate. Results of the thirty-first Certificate Examination—Housecraft for Demonstrators and Saleswomen bring the total of successful candidates to 1,849. This year 109 entrants qualified for the Certificate, five gaining distinction. Finally, a further 36 candidates were successful in the Certificate Examination for Teachers, the twenty-eighth to be held, bringing the total number of certificate holders to 1,737.

Two New Branches

NEW branches of E.A.W. are being formed rapidly all over the British Isles. The most recent additions are at Galashiels and Burton-on-Trent, where meetings were attended by local civic personalities, representatives of the Area Boards and E.A.W. members from neighbouring branches. Elected chairmen are Mrs. Beattie at Galashiels and Mrs. A. Chadwick at Burton.

Any Questions at "The Feathers"

SPECIAL importance is attached to the Questions Forum which follows the general meeting of the Electrical Trades Commercial Travellers Association being held at the "Feathers Hotel," Broadway, London S.W.1, tomorrow, Friday.

The event, always most entertaining, is particularly notable this year in view of the eminent speakers who comprise the team.

Beginning at 6.45 p.m., the Forum will be charted by W. H. Williams, Esq., President, E.T.C.T.A., as Question Master, and questions will be answered by a team comprising Sir Herbert Williams, M.SC., M.ENG., A.M.INST.C.E., M.P. for Croydon E., A. M. Low, the scientist, George Schwartz, journalist and economist, and Collin Brooks, M.C., well-known author and broadcaster.

E.I.B.A. B'HAM DANCE

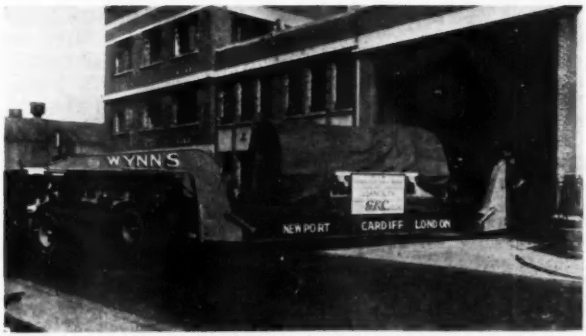
BIRMINGHAM branch of E.I.B.A. has announced that its annual Carnival Dance is to be held this year on October 3 at the Magnet Club, G.E.C. Witton Works. We understand that tickets are now available and may be obtained at 5s. each from the branch's hon. sec., Mr. L. Wall, c/o Electrical Components, Ltd., 102 Snow Hill, Birmingham 4.

Walsall Conduits Ltd. have just moved into new and more spacious accommodation at Ferry Hinksey Road, Oxford. These premises, shown here, were officially opened by Mrs. A. E. Millard, wife of the managing director. Mr. J. Bines is the branch manager

Squandering of Electricity Alleged

APPROVING the national plan to reduce demand of electricity by 10% among industrial consumers and commercial consumers using 20 kW or over, members of the Halifax Electricity Load Spreading Committee criticised the squandering of power by domestic users. An instance was given by one member, of factory workers who had had to comply with staggered hours witnessing homes and shops where there was no curtailment on the use of electricity at all. Domestic consumers were allowed to do what they liked while industry was asked to bear the burden of winter shortages. Another member pointed out that appeals to domestic users invariably fell on deaf ears. In view of the fact that there had been little attempt to check the supply of domestic appliances, one appeared to have reached a dead-end, he added. A third person stated that it was easier to seek the co-operation of industry.

In defence of the small consumer, it was said that economy had to be studied in the home in nearly every sphere these days and electricity would not be used unnecessarily. Money was hard to come by and working men could not afford wastage of any sort.



Part of the first of six 60 MW 11.8 kV hydrogen-cooled alternators destined for the new Uskmouth power station leaving the G.E.C.'s Witton works, Birmingham. The stator of the machine shown here weighs nearly 100 tons. Incidentally, orders are in hand for 15 machines of this type and rating together with seventeen 30 MW sets for Britain and the Dominions

NEWS IN BRIEF

Thorn Electrical Industries, Ltd., are the latest to publish an attractive, lucid and well-illustrated brochure explaining and including their annual report and accounts.

Queen Mary has accepted from Lord Latham, chairman of the London Transport Executive, a souvenir album commemorating the era of trams in London. Her Majesty was present at the inauguration of the electric tram service in 1903.

Annual conference of the Institution of Works Managers, which this year will commemorate the Institution's 21st birthday, is to be held in Birmingham between October 16 and 18.

W. Watson and Sons, Ltd., are staging an exhibition, "The Microscope in Industry and Research," at the New Horticultural Hall, Westminster, between September 15 and 19.

Royal Photographic Society's 97th annual exhibition opens at 16 Princes Gate, London, today. It remains open daily until October 12.

Electric Supply News . . .

Cumberland

The County Council has discussed with the North-Western Electricity Board the question of supplying electricity to Irthing Valley School. The Council, however, is not in favour of the Board's plans for the erection of h.t. lines over school property, and it is suggested that these be placed underground. The Board states that the Council would be expected to pay the extra cost of putting the cables underground.

Maidstone

Proposed new charges by the South-Eastern Electricity Board on the Shepway Estate, Maidstone, are to be opposed by the Town Council. The charges are for service cables in excess of 15 ft, and the houses are 20 ft from the road. They would mean an average payment of £4 10s. for each house, it is stated.

Nottingham

The B.E.A. has received the formal consent of the Minister of Fuel and Power to the extension of the Nottingham power station (East Midlands Division) by the installation of one 60 MW turbo-alternator and two 300 k lb/hr boilers. The present installed capacity of the station is 254 MW.

South-West Scotland

Schemes to provide electricity for three collieries have been approved by the South-West Scotland Electricity Board. The scheme for the Northfield Colliery, Shotts, is estimated to cost £37,804; that for Whitehill Colliery, Cumnock, £10,543; and for the Killoch Colliery, Cumnock, £9,336.

Suffolk

At last week's meeting of the Blyth R.D.C. it was stated that the Eastern Electricity Board did not contemplate that the Council houses at Great Glenham and Stratford St. Andrew would be connected up before 1954, although the houses had been wired before the present restrictions on capital expenditure were made. One member said he proposed to raise the matter at the next meeting of the Consultative Council.

Worcestershire

In an effort to obtain an early supply of electricity the village of Stoke Bliss, Worcestershire, enlisted the aid of two M.P.s, one of whom, Mr. Gerald Nabarro, M.P. for Kidderminster, has now informed the Rev. J. K. W. Thomas, of Stoke Bliss, that he has completely failed to obtain a promise for a supply earlier than 1956. The position arises, he says, because the Midlands Electricity Board is "almost an autonomous or self-governing body." Mr. Nabarro failed to prevail upon the Midland Electricity Board and so did the Minister of Housing and Local Government and the Minister of Fuel and Power, notwithstanding the support of the N.F.U. The matter was also referred to the Ridley Committee, so Stoke Bliss electricity supply has made history, he added. "Until control of nationalised industries is changed by Parliament, and I have long been an advocate of such a change, the Midlands Electricity Board and other Area Boards will be able to do precisely as they like in matters of rural electrification, without any sort of ministerial control, without heeding representations made by local Members of Parliament, the farmers' representatives or anybody else. The Midlands Electricity Board in this instance demonstrates that it behaves as an autocracy," Mr. Nabarro states.

We gather that the M.E.B. told the village there could be no supply before 1956 unless the farmers could meet an annual guarantee of £1,131. Some 8,820 yd of h.t. and l.t. line, 12 transformer sub stations and £5,600 worth of services and meters would be required.

LIGHTING SCHEMES

Aberdeen.—The T.C. has approved a recommendation of the Lord Provost's Committee that coloured decorative lighting should be provided at Union Terrace Gardens. Cost of the scheme is estimated at £850.

Bridgnorth.—T.C. has approved the replacement of existing gas lighting in the town by electricity over a period of years, and the preparation of a scheme for electric lighting on The Grove.

Chatteris.—Plan for the conversion of street lighting from gas to electricity is being considered by the U.D.C.

Guildford.—T.C. works committee recommends approval to a scheme for lighting in Aldershot Road at a cost of £3,400, and for improved lighting in Onslow Street at a cost of £1,600.

Smethwick T.C.—Tenders likely to be invited soon for first year's programme of public lighting by electricity. Estimated cost is £15,500.

Spenborough.—U.D.C. Surveyor to prepare scheme for conversion of street lighting in Bradford Road, Birkenshaw.

Spondon.—The Parish Council is seeking a Government grant for the lighting of part of Nottingham Road.

Stourbridge.—The M.o.T. has declined to authorise the whole of the T.C.'s proposed extension of electric street lighting. The divisional road engineer, however, is prepared to recommend approval of the extension of lighting in Foster Street, Coventry Street, and Stourbridge Road. The borough surveyor is to obtain tenders for that scheme.

Sutton Courtenay.—The parish council is seeking sanction to borrow £1,250 to provide sixty street lamps.

Company Activities . . .

Calcutta Tramways Co.

For 1951, the traffic and sundry receipts totalled £1,781,922 (*£1,602,450*), but there was also a corresponding rise in working costs, including maintenance and repairs, traffic and general expenses, at £1,358,007 (*£1,251,856*), so that the balance is £423,915 (*£350,594*). Adding investment and other income, and charging London expenditure, directors' and auditors' fees, etc., and placing £80,000 (*same*) to renewal and replacement account, there is left £325,856 (*£257,400*). To income tax £150,000 (*£122,000*), debenture interest £25,939 (*£30,693, including redemption provision*), there is £87,457 for the shareholders' account and £74,354 transferred to special reserve, after allowing a tax credit of £11,894 (*£11,594*). These 1951 accounts have been drawn up on the basis of the August, 1951, agreement with the Governor of West Bengal, the directors state. For 1950 there was a balance of £56,341, after placing £60,000 to improvements reserve. The 6% Ordinary dividend absorbs £42,000.

George Cohen, Son and Co., Ltd.

Turnover of the group for the year to March 31 last was some £3 million more than the previous year at £14,800,000, while the profit at £1,826,000 was a record for the concern. The net worth of the group stands at £4,731,000 of which £1,688,000 is applicable to Preference stockholders. The stake of the Ordinary stockholders is £3,043,000, and this compares with its "nominal" value of £600,000. It follows that for every £5 which the Ordinary stockholders have in the group, they hold stock that only carries a "nominal" value of £1, Mr. C. M. Cohen, chairman, points out. Therefore the nominal value of the stock is misleading, and to bring the relationship more into line with reality and at the same time to strengthen the capital structure, the directors recommend the capitalisation of £900,000 group reserves. Application is to be made for consent of the C.I.C. This proposal should not be interpreted as foreshadowing a further issue of stock for cash.

Electric Construction Co.

The directors are making arrangements for a rights issue to Ordinary shareholders. The issue will consist of an offer of two £1 shares for every seven units held, at a price of 42s. 9d. per share, we learn.

Kalgoorlie Electric Power & L. Corpn.

After allowing for all charges, operations for 1951 resulted in a net loss of £3,507, as against a profit of £6,547 for the previous year. U.K. tax nil (*£46*), to depreciation reserve nil (*£6,000*), commitments outstanding for purchases of plant and machinery not delivered at the end of the year £91,000 (*£120,000*), and there is carried forward £3,792 (*£7,299*). The Board points out that the necessary authority given to increase its power charges applied only from June 1, 1951, and was not sufficient to fully remedy the adverse result of the first five months of that year.

Metal Industries Ltd.

Reviewing the activities of the Electrical Division of this concern at the meeting last week, Mr. R. W. McCrowe, chairman, said Brookhirst Switchgear Ltd. and Igranic Electric Co. Ltd. had record years. Cantie Switches, a smaller company, had so far been subject to development difficulties, but the corner had now been turned, and as a result of thorough reorganisation, was now on a profit-earning basis, he said. The Electrical Division continued to work at full pressure, with a large fund of orders on hand.

Palestine Electric Corporation

The directors have decided not to recommend the payment of a dividend for 1951 on the Ordinary stock and shares and the "A" Ordinary stock. For 1950 there was a 5% dividend, tax free. This has been decided upon, having regard to the steep rise in the operating costs not accompanied by a proportionate increase in electricity tariffs, conditions which have been intensified in the present year, together with the necessity of conserving cash resources for capital expenditure. After including an income tax refund on account of previous years of I£119,618 (*I£22,314*), and allowing all charges including I£100,000 (*I£255,000*) for taxation, the net profits are I£221,809, as against I£208,620 for the previous year after placing I£125,000 to general reserve.

Parmiter, Hope & Sugden

In spite of the shortages of metals, turnover had risen to approximately the record value of earlier years, and the fact that this had not been accompanied by an increase in profits, but by a small decline, was not disquieting, in the view of Mr. E. W. Sugden, chairman. In the first place, the directors felt it in the best interests of the future of the company to keep its prices as stable as possible, despite sharp increases in many material costs, and an inevitable rise of about 10% in the firm's prices was delayed until the turn of the calendar year, and was itself moderate in comparison with the cost increases, Mr. Sugden states.

Dividends Declared

British Thermostat Co.—Interim of 7½% (*same*).

Lancashire Dynamo Holdings.—Interim of 4% (*same*).

A. H. Hunt (Capacitors), Ltd.—Interim of 7½% (*same*), payable on October 18.

Telegraph Condenser Co.—Ordinary interim of 5% (*same*).

Crofts Engineers (Holdings).—Interim of 15% (*same*), payable on September 30.

Commercial Information

CONTRACTS OPEN

HOME

Sept. 12.—Edinburgh. Lighting and power installations in 90 houses and 15 shops on Inch Housing Development. City Architect's Office, City Chambers.

Sept. 12.—Kendal T.C. Provision and installation of 72 mercury vapour lighting units and 7 fluorescent units, in Group A, including concrete columns and auxiliary equipment and wiring along Windermere Rd. Borough Engineer and Surveyor, Municipal Offices, Lowther Street. (See July 24 issue.)

Sept. 12.—Sheffield T.C. Electrical installations in 652 dwellings on the Hachenthorpe estate, in 54 dwellings on the Basegreen estate, and in 50 dwellings on the Birley estate. W. G. Davies, City Architect, Town Hall, Sheffield 1. Deposit £1.

Sept. 12.—Sheffield. Electrical installation in Hurlfield secondary school. W. Geo. Davies, City Architect, Town Hall. Deposit £2.

Sept. 13.—Consett (Dur.) U.D.C. Installation of electric lighting in 34 houses at Shotley Bridge. Applications to E. Simpkin, Surveyor, Council Offices, Medomsley Rd., by above date.

Sept. 15.—Inverness. Wiring and re-wiring of 39 staff houses for N. Regional Hospital Board at Craig Dunain Hospital. Architect to Board, Raigmore Hospital.

Sept. 15.—Tayport (Fifeshire) T.C. Electrical work in conversion of 26 houses in Shanwell Rd. South. Applications by above date to J. G. Gordon Simpson, Town Clerk, Burgh Chambers.

Sept. 16.—Wigan T.C. Wiring of 172 dwellings on Smethurst Lane estate. Borough Engineer, Municipal Buildings, Hewlett St. Deposit £1 1s.

Sept. 17.—Grantown-on-Spey (Morayshire) T.C. Electrical work in two blocks of houses at Kylintra. A. Cattanach, Architect, Kingussie.

Sept. 17.—Manchester. West Manchester Hospital Committee requires supply of electric lamps for year starting Nov. 1. Secretary, Park Hospital, Davyhulme, Urmston.

Sept. 18.—Durham T.C. Erection only of 18 street lighting units in North Rd., Durham. The steel columns, lanterns and control gear will be provided by the Council. City Engineer, Town Hall, Durham.

Sept. 18.—Manchester T.C. Alterations and additions to electrical installation at Bostock Hall, near Northwick. City Architect, Town Hall, Manchester. Deposit £1 1s. (See August 18 issue.)

Sept. 19.—Aberdeen. Electrical work in erection of school at Aboyne. Geo. Bennett Mitchell and Son, Architects, 1 West Craibstone St., Bon-Accord Sq.

Sept. 19.—Manchester. Alterations and additions to electrical installation at New Moston junior school. City Architect, Town Hall. Deposit £1 1s.

Sept. 19.—Neston U.D.C. Supply and erection of 32 electric lighting columns, height 25 ft, for fluorescent and sodium lamps, together with all necessary control gear and fuses. Engineer and Surveyor, Town Hall, Neston. Deposit £1 1s.

Sept. 19.—Northern Ireland. Complete electrical installation at fire station in Valentia Place, Newcastle. Kirk and McClure, Civil Engineers and Surveyors, 19 Adelaide St., Belfast.

Sept. 22.—Berwickshire C.C. Electrical work in 7 houses at Lower Burnmouth. County Surveyor, Duns.

Sept. 22.—Haverfordwest T.C. Installation of electric light and power in about 143 houses in scheme No. 2. Borough Surveyor, 9 Victoria Place. Deposit £2.

Sept. 22.—Nottingham Education Committee. Stage 1 of the re-wiring of the Nottingham and district Technical College, Shakespeare St., Nottingham, including mains, switchgear and final circuit wiring for complete new lighting and power schemes, including the supply and erection of all lighting fittings. Particulars from consulting engineers, E. G. Phillips, Son and Norfolk, Arskus House, Annesley Grove, Nottingham. Deposit £2. (See September 4 issue.)

Sept. 24.—Newcastle-on-Tyne. Electrical installation in 120 flats and maisonettes on Hindhaugh St. site. City Architect, 18 Cloth Market, Newcastle.

Sept. 24.—Tyrone. Electric lighting and heating installation at new Carnteel primary school. A. Gibson, Chief Education Officer, Education Offices, Omagh.

Sept. 26.—Castle Ward R.D.C. Electrical installation in 100 houses at Ponteland. G. E. Dimmack, Engineer and Surveyor, North Rd., Ponteland. Deposit £2 2s.

Sept. 26.—Glendale R.D.C. Supply of electric cookers for 43 houses. J. Baston, Clerk of the Council, Council Offices, Wooler.

Sept. 27.—Barry T.C. Installation of street lighting to Group A standard along 3¼ miles of roads in the borough. Schemes are to be submitted for the complete works of dismantling existing lighting installations, supply and erection of columns and fittings and electrical connections to mains. Borough Engineer and Surveyor, Town Hall, Tynewydd Rd., Barry.

Sept. 27.—Caerphilly U.D.C. Supply, erection and servicing of 42 Group A lighting standards with 140 W sodium lamps and lanterns along four roads. Names to Engineer and Surveyor, Council Offices by Sept. 13.

Sept. 29.—West Riding. Renewal of electrical installation at Harrogate School of Art. County Architect, "Bishopgarth," Westfield Rd., Wakefield. Deposit £2 2s.

Oct. 1.—Dalkeith T.C. Electrical work in 80 houses at Woodburn. Particulars from the Surveyors, Morham and Brotchie, 29 Hanover St., Edinburgh.

Oct. 3.—Brockhall (Lancs). Hospital Committee requires supply of electric lamps for year beginning Nov. 1. Secretary is M. Lawrence, Brockhall Hospital, Langho, nr. Blackburn.

Oct. 3.—Manchester. Provision of sundry electrical engineering

equipment in connection with extension to Municipal College of Technology. Details from Acting Principal, College of Technology. (Advertised in this issue.)

Oct. 3.—Portsmouth T.C. Supply and installation of an electrically operated air conditioning and gas filtration plant at the civil defence main control, Fort Widley. City Engineer, Council Chambers, 1 Clarence Parade, Portsmouth. Deposit £2 2s.

Oct. 4.—Saddleworth U.D.C. Installation of 140 W sodium lighting on A670 road from Oldham to Standedge. G. H. Booth, Lighting Superintendent, Council Offices, Uppermill, nr. Oldham.

Oct. 8.—Goole T.C. Vertical spindle centrifugal pump, 75,000 gal/hr. against static head of 210 ft, with electric motor, for Pollington Waterworks. Silcock and Simpson, Consulting Engineers, 10 Park Row, Leeds. Deposit £5.

Oct. 14.—Cork. Electrical installation at the Southern Regional Sanatorium, Sarsfields Court, Glanmire, now under construction for the Department of Public Health, to house 344 patients. Work comprises 220/380 V installation for lighting, heating, cooking, sterilising, water heating, etc., and low voltage installation 12-100 V for nurses' call systems, telephones, radio and p.a. remote control, clocks, etc., and the supply and fixing of specified equipment, appliances and fittings. P. O. Cinneide, secretary, Department of Public Health, Custom House, Dublin. Deposit £20.

No date stated.—Aberdeen. Electrical work in erection of infant school at Cummings Park: J. A. O. Allan, Ross and Allan, Architects, 10 Bon-Accord Sq.

OVERSEAS

Details of items marked may be obtained on application to the Board of Trade, Horseguards Avenue, S.W.1, quoting reference.*

Sept. 25.—Peru. Supply of electrical control equipment for State power stations including 4,000 current limiters for service voltage of 220 V, 60 c/s for Direccion de Industrias y Electricidad. B.o.T. (Ref.: CRE 29961/52)*.

Sept. 25.—Peru. Equipment for hydro-electric station at Cajamarca, including one water turbine, automatic speed regulator, and a 100 kVA, 230 V alternator, and control board. B.o.T. (Ref.: CRE 29965/52).*

Oct. 1.—Syria. Directorate-General, Syrian Broadcasting Service at Damascus requires supply and erection of V.H.F. broadcast links between Damascus and Sabbourah and a mobile outside broadcast van. B.o.T. (Ref.: CRE 29985/52)*.

Oct. 2.—Argentine. Supply of seven electric locomotives, gauge 1.676 metres, 800 V, 1500/2000 h.p., for Transport Ministry. Documents from Office No. 515, Avenida Libertador, General San Martin y Maipu', Buenos Aires.

Oct. 2.—South Africa. Tenders invited for supply of train-lighting dynamos and auxiliaries by S. African Railways, P.O. Box 7784, Johannesburg. B.o.T. (Ref. CRE 30472/52).*

Oct. 2.—South Africa. 192,000 ft of armoured signalling cable, 8/·036, s.c.; 352 complete train lighting dynamos and control equipment, with spares; and 12 air compressors; for South African Railways. Details from Chief Stores Superintendent, Room 202, Park Chambers Rissik Street, Johannesburg.

Oct. 2. — Syria. Substation equipment and 13·5 kV transmission line for Damascus Electricity Administration. B.o.T. (Ref. CRE 28863/52).*

Oct. 8.—Australia. (a) Twenty-four 3,450 kVA 6·6 kV automatic induction voltage regulators; (b) six 2,500 kVA 22 kV ditto; (c) eight 5,000 kVA 22 kV ditto; and (d) four 10,000 kVA 22 kV, for State Electricity Commission of Victoria. B.o.T. (Ref. CRE 29716/52).*

Oct. 8.—Portuguese West Africa. Supply of 60,730 metres of telephone cable, wire and accessories for Dept. of Posts, Telegraphs and Telephones at Angola. B.o.T. (Ref. CRE 27779/52).*

Oct. 14.—Uruguay. Supply of 300,000 metres of copper conductor, black vulcanised insulation for open air. Usinas Electricas y Telefonos del Estado. B.o.T. (Ref. CRE 30203/52).*

Oct. 15.—Uruguay. Supply of 14,300 metres of lead covered conductors for normal tension of 200 V. Usinas Electricas y

Your Queries — Answered

Sockets, 15 amp, 3-pin, with a brass hinged lid for recessing into floors, makers of? B.B.—Julius Sax and Co., Ltd., 24 Commerce Rd., Brentford. (23864)

Electrically operated butter churns for domestic use, makers of? A.B.—Try: J. J. Blow Ltd., Oldfield Works, Chatsworth Rd., Chesterfield; Churn Co., Station Rd., Hailsham, Sussex; Bulpitt and Sons, Ltd., 132 Icknield St., Birmingham 18. (23871)

Gem Labour Saving Device Co., Ltd., address of? I.E.—This firm went out of business in 1935. Try: Gem and Radio Service Co., 233 Cricklewood Broadway, N.W.2, regarding repairs to the "Gem" vacuum cleaners. (23882)

"Towers" ovens, makers of? B.C.—J. W. Towers and Co., Ltd., Victoria House, Croft St., Widnes, Lancs. (23887)

"Ticonal" magnets, makers of? T.E.—Philips Electrical Ltd., Century House, Shaftesbury Ave., W.C.2. (23894)

"Aquastat" and "Superstat" electrical water treatment apparatus, makers of? B.E.—Aquastat Ltd., Romney House, Marsham St., S.W.1, and Superstat Ltd., 78 Bollo Bridge Rd., London, W.3, respectively. (23898)

"Orel" shavers, address for spares? L. E.—E. Siegrist Ltd., 39 Berners St., London W.1. (23904)

The above are selected from questions we have answered this week. If you have a query, send it to us.

ANSWER WANTED

"Beacon" immersion heaters, makers of? C.M. (23909)

Telefonos del Estado. B.o.T. (Ref.: CRE 30222/52)*.

Oct. 23.—Australia. Supply of 2,000 type switch maintenance parts for Director, Posts and Telegraphs, Melbourne C.1. B.o.T. (Ref.: CRE 30038/52)*.

Nov. 14.—Northern Rhodesia. 11 kV and l.t. cables, switchgear and transformers for Northern Rhodesia Government. Details from consulting engineer, P.O. Box 4648, Johannesburg. Deposit £3 3s.

PRICES OF CABLE METALS AND OTHER MATERIALS
(at Tuesday night)

	£ s. d.	New York price
COPPER, electrolytic	285 0 0	—
LEAD, good soft pig (foreign)	131 0 0	£128 0 0
,, ,, ,, "English" quality ...	132 10 0	
Tin (99-99.76%) ... ...(Cash)	965-966	—
,, (3 months)	954½-955½	—
ALUMINIUM, commercial purity (del.)	157 0 0	—
ZINC	122 0 0	112 0 0
ARMOURING:		
Galv. Steel Wire (0.104 in.) ...	54 0 0	—
Mild Steel Tape (0.04 in.)	39 15 0	—

GAZETTE ANNOUNCEMENTS

COMPANIES ACTS

Electrical Development Co. (Chester) Ltd. Resolution for voluntary winding-up passed at meeting on August 22. Subsequently creditors have appointed Eric Stevenson Browne, C.A., 41 North John St., Liverpool 2, as liquidator, to whom creditors are asked to send particulars by October 31.

Electronics (Clayton) Ltd. Resolution for voluntary winding-up passed at meeting on Aug. 25. Eric Hodgkinson, C.A., 15 Avenue Parade, Accrington, has been appointed liquidator and creditors are asked to send particulars to him by Sept. 15.

Ely Valley Lighting Co., Ltd. Meeting of members is to be held at 48 Mount Stuart Sq., Cardiff, on Oct. 16 at 12.30 p.m. to receive liquidators' report.

James Poole and Co. Ltd. Resolution for winding-up passed at meeting on August 29. William Le'Resche Hand, Incorp. Acc., Fletcher's Chambers, Fore St., Birmingham 2, has been appointed liquidator, and creditors are asked to send particulars to him by September 30.

Jay-Vee Engineering Products Ltd., of Wakes Colne, nr. Colchester. Supplementary dividends of 1d. in £ payable tomorrow (Fri.) at 17 Museum St., Ipswich.

Overseas Engineering Co. Ltd. Meeting of creditors will be held at Winchester House, Old Broad St., E.C.2, on September 16 at 11.30 a.m.

Companies Winding-up

Gamma Electronics Ltd., of Slough Trading Estate, Bucks, radio and electrical engineers. At first meeting of creditors official receiver reported that winding-up order was made on July 28. Statement of affairs disclosed gross liabilities of £31,124 which comprised: preferential claims, £5,184; debentures, £14,274; trade creditors, £5,599; claims under guarantees, £50; and claim by the directors, £6,017. The gross assets were put at £2,417. No resolution was passed and matter was left in hands of official receiver as liquidator.

BANKRUPTCY ACTS

Appointment of Trustee

Boston. Leslie J. Anthony, trading in partnership as Dolphin Electric Co. at 6 Dolphin Lane, Boston. Trustee is C. G. Compton, Inc. Acc., 2 New St., Boston.

Release of Trustees

Leeds. Philip H. Leach, radio and electrical engineer trading at 4 Oxford St., Guiseley, and 6 and 8 Town St., Yeadon. Trustee was K. Russam, C.A., 2a Tyrrel St., Bradford.

Newcastle-on-Tyne. Samuel I. Rae, trading as "S. I. Rae," electrical contractor, at 1 Ashburton Rd., Gosforth. Trustee was G. Barr, Cert. Acc., 135 Sandyford Rd., Newcastle.

Wolverhampton. Joseph H. Bourne, trading as The Amplifier Illumination Co., at Rayleigh Works, Powlett St., Wolverhampton, and in partnership as E. Desborough and Sons at same address. A. M. Baker, C.A., 12 Waterloo Rd., Wolverhampton, was trustee.

Public Examination

Manchester. Frank J. Crutchley, electrical engineer trading as "Frank Crutchley" at 9 York St., Hulme. Public examination at Court House, Quay St., Manchester, on Oct. 17 at 10.30 a.m. First meeting took place yesterday (Wed.).

Intended Dividends

Ashton-under-Lyne. Frank Simcox, trading as Simcox Signs, at 116 Wellington St., and Bradgate St. Works, Ashton. Last day for receiving proofs, Sept. 20. Trustee is A. T. Eaves, 47 Mosley St., Manchester.

Derby. Leslie R. Maisey, electrical contractor trading at 3 Main Rd., Jacksdale. Last day for receiving proofs, Sept. 19. Trustee is F. W. Flint, 5 Regent St., Nottingham.

London. Leo. L. O'Connor, electrical engineer, of 27 Wellington Sq., S.W.3. Last day for receiving proofs, Sept. 22. Trustee is F. H. Langmaid, Official Receiver, Bankruptcy Bldgs., Carey St., W.C.2.

Sheffield. Alfred Parsons, electrician trading at 25 High St., Rotherham. Last day for receiving proofs, September 17. Trustee is J. B. G. Moore, Official Receiver, 55 Queen St., Sheffield 1.

Wigan. John Bannister, electrical contractor, trading at 2 The Wiend, Wigan, Last day for receiving proofs, Sept. 20. Trustee is A. T. Eaves, 47 Mosley St., Manchester.

Dividends

London. Raymond H. Tuck, trading as London Electrical Contractors, at 109 Gt. Russell St., W.C.1, and 9 Newman St., W.1, and in partnership as Brotherton and Tuck at the last mentioned address. Supplemental dividends of 3½d. in £ payable on Sept. 16 at Bankruptcy Bldgs., Carey St., W.C.2.

CONTRACTS PLACED

Biddulph (Staffs) U.D.C. Electrical installation in 90 houses on Park Lane estate, Electrical Services, £1,633.

Colchester. Electrical installation at Technical College in Sheepen Rd., M.G. (Colchester) Electric Ltd., £12,300.

Middlesbrough T.C. Electrical work in providing 123 extra lamps, N. Eastern Electricity Board, £6,748.

BUSINESS PROSPECTS

HOME

Aldershot T.C. Construction of 108 flats in Denmark Sq. F. W. Taylor, borough engineer and surveyor, Municipal Buildings.

Bolton T.C. Tenders to be invited for electrical re-wiring of Halliwell and Great Lever branch libraries.

Carlton U.D.C. Construction of 66 dwellings off Foxhill Rd. J. R. Campbell, Engineer and Surveyor, Council House, Burton Road.

Clitheroe (Lancs). Approval sought for scheme comprising 346 houses and 36 bungalows, shops on site No. 5, Henthorne.

Cumberland. A £4,000 fire station to be built at Egremont. Also a junior and infant school is to be built at Workington at cost of £90,000.

Eastbourne. Armour and Co. Ltd. are to build laboratory on Brampton Rd. trading estate.

Ellesmere Port U.D.C. Construction of 70 houses in Mill Lane and 34 in Overpool Rd. Council's Engineer and Surveyor, Queen Street.

Guernsey. Erection of four blocks of three-storey flats in Victoria Ave. States Engineer, States Office Annexe, Albert Pier.

Guildford. Erection of 47 dwellings on Cardinals estate. J. W. Wilton, engineer and surveyor, Millmead House.

Harrow U.D.C. Erection of 58 dwellings at Cannon Croft. J. H. Melville Richards, engineer and surveyor, Council Offices, "Coltesmore," Uxbridge Rd., Stanmore.

Heanor (Devon) U.D.C. Erection of 40 houses off Greenfields, Aldercar. R. Archer, Engineer and Surveyor, Council Offices.

Hemel Hempstead T.C. Erection of 90 houses and 12 flats on Adeyfield estate and 38 houses on Beechfield estate. A. H. Turner, borough engineer and surveyor, Market Square.

Ilford. Schemes in hand in neighbourhood include new welding shop in Uphall Rd. for Howards and Sons Ltd.; extension to synagogue in Becontree Ave. for United Synagogue; and block of offices in Cranbrook Rd. for Suburban Developments (Ilford) Ltd.

N. Ireland. Construction of 296 dwellings at Falls No. 3 for N.I. Housing Trust, 12 Hope St., Belfast.

Kesteven. Next year's school building programme includes junior and secondary schools at Grantham and secondary schools at Market Deeping, Stanford, Ruskington and Branston.

Larne (Antrim) U.D.C. Erection of 52 houses being first of scheme comprising 244 houses. R. Lyttle, town clerk, Town Hall.

Leyton T.C. Erection of 27 flats and maisonnettes in Park Grove Rd. area. Borough Engineer and Surveyor, Town Hall, E.10.

Maidenhead. N.W. Metropolitan Hospital Board propose to carry out improvements at Canadian Red Cross Memorial Hospital, Taplow, at estimated cost of £14,692.

Maidstone. Licence has been issued to Canterbury Diocesan Board of Finance valued at £11,680 for church, hall and vicarage on Shepway estate.

Manchester. Approval sought for three schemes. That in Charlestown neighbourhood involves some 216 dwellings; that on Hillside estate 139 dwellings, and 63 flats in Moss Nook neighbourhood.

Mitcham (Surrey) T.C. Construction of 66 maisonnettes on Baron House estate. Borough Engineer and Surveyor, Town Hall.

Morpeth R.D.C. Construction of 40 houses on Hadstone site, Broomhill. Surveyor is J. R. Miles, Dacre Street.

Newtownards. Approval granted for erection of two buildings at Ards Hospital. Estimated cost, £80,000.

Norwich. Plans in hand for 152 dwellings in Hall Rd., 409 on S. Tuckwood estate, 66 flats in Whalebone Sq., and 30 in Victoria St.

Rochford (Essex) R.D.C. Erection of 46 dwellings in Rochford Garden Way. Engineer and Surveyor, Council Offices.

Scunthorpe T.C. Construction of 36 flats on New Brumby estate. Borough Engineer and Surveyor, Comforts Ave.

Sittingbourne and Milton U.D.C. Erection of 36 flats to complete Canterbury Rd. estate. Engineer and Surveyor, High St., Sittingbourne.

Stafford. Plans approved for civic centre on cattle market site. First stage estimated to cost £69,500 of a total £290,000.

St. Neots T.C. Proposal for public hall is being considered. Plans by Borough Architect.

Stone (Staffs). Block of shops and flats to be built at Barlaston.

Sunderland. Temporary extension planned at Pallion factory of Fordham and Co.

Thornton Cleveleys (Lancs) U.D.C. Erection of 58 houses on Marsh Heys estate. H. Anderson, engineer and surveyor, Council Offices, Fleetwood Rd., Thornton.

Torquay T.C. Tenders are shortly to be invited for electrical installation in 147 houses and flats on Sherwell Valley estate.

Walton and Weybridge U.D.C. Erection of 40 houses on Cottimore Lane estate and 18 flats in Sidney Rd. Engineer and Surveyor, The Council Offices, Walton-on-Thames.

Watford. Plans prepared for 84 houses on Cecil Lodge estate, Abbots Langley.

West Hartlepool T.C. Erection of Rossmere primary school. A. G. Sinclair, Borough Architect, Municipal Buildings.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Aluplas, with design 707,665. Class 9. Insulated electric wires and electric cables. Sterling Cable Co. Ltd., Sterling Works, Aldermaston, Berks.

Celtic. 707,434. Class 9. Electric batteries for motor vehicles. Supac Electric Co., Ltd., 25 Edwardsville, Treharris, Glam.

Davu Wires, Cables in design. 705,455. Class 9. Electric cables and insulated electric wires. J Day and Co. (Derby Works) Ltd., Harrow Manor Way, Abbey Wood, S.E.2.

Dictovox. 706,832. Class 9. Sound recording and reproducing apparatus and instruments. Primar Electronic and Technical Products Ltd., 435 Grand Buildings, Trafalgar Square, W.C.2.

Lummus. B697,216. Class 7. Steam jet ejectors, etc., B697,218. Class 11. Installations for steam generating, etc. Lummus Co., 420 Lexington Ave., New York 17, U.S.A.

TRADE NOTES

Australasian Co. The David Brown group has now formed a new company, David Brown (Australasia) Proprietary, Ltd., with headquarters at 82 Pitt Street, Sydney, New South Wales. This concern will be responsible for the importation and distribution throughout Australasia of the products of David Brown Tractors (Engineering), Ltd. Mr. P. J. Clifford, former export sales manager at Meltham, who went out to Australia a year ago, has been appointed manager of the new company.

Distributors. Stanton Instruments, Ltd., have appointed sole distributors for U.S.A. and India. These are Martin and Harris, Ltd., Savoy Chambers, Wallace Street, Fort, Bombay, for India, and Burrell Corporation, 2223 Fifth Avenue, Pittsburgh 19, Penn., for the U.S.A.

For Convenience. The London showrooms of Villiers Engineering Co., Ltd., at 190 Piccadilly, W.1, are open on Saturday mornings from 9 a.m. to 12.30 p.m.

Lebanese Changes. Among changes in the Lebanese customs tariff, just revealed, the duty on electricity meters is reduced to 15% *ad valorem*; for cables of 3 or 4-core each over 20/10 mm dia., the new rate is 1% and for other insulated cables and wire, 25%; insulators for 1,000 V or over are now charged at 1% and all others at 25%; for l.t. starters for motors of 5 h.p. and over, circuit-breakers, switchgear of over 100 amp, control switchboards for power stations, regulators and protection relays, the duty is 1%, and for other electrical apparatus 25%.

New Factory. Work has just started at Basildon New Town, Essex, on a £600,000 factory for the Marconi group of companies.

MEETINGS TO NOTE

THURSDAY, SEPT. 11

INCORP. PLANT ENGRS. (Newcastle Branch).—"Liquid Fuel Firing." Alan Moore. Roadway House, Oxford St., 7.30 p.m.

FRIDAY, SEPT. 12

ELECTRICAL TRADES COMMERCIAL TRAVELLERS ASSCN.—General meeting, 5.45 p.m., followed by "Question Forum," at 7 p.m. Feathers Hotel, Broadway, S.W.1.

MONDAY, SEPT. 15

BIRMINGHAM ELECTRIC CLUB.—President's Night.
Extraordinary general meeting. Midland Hotel, New St., 6.15 p.m.

INCORP. PLANT ENGRS. (Liverpool and N. Wales Branch).—"Amenities in Industry." H. S. Crump. Radiant House, Bold St., 7.15 p.m.

A.S.E.E. (N.W. London Branch).—"Electronically Controlled Driving Equipment." F. Ralph. Prince of Wales Hotel, Kingsbury, 7.30 p.m.

TUESDAY, SEPT. 16

INCORP. PLANT ENGRS. (Glasgow Branch). — "Mechanical Handling Equipment and Methods." F. T. Dean. Engineering Centre, Sauchiehall St., 7 p.m.

A.P.L.E.—Annual conference and exhibition at Harrogate. Closes on Sept. 20.

INCORP. PLANT ENGRS. (St. Albans Branch).—Discussion on "Radio and TV Interference." C. E. Hollingworth. Peahen Hotel, 7.30 p.m.

INSTN. OF HEATING AND VENTILATING ENGRS. (Liverpool Branch).—Chairman's address and "Training of Heating and Ventilating Engineer," by J. W. Winning. Radiant House, Bold St., 6.30 p.m.

WEDNESDAY, SEPT. 17

A.S.E.E. (S.W. London Branch).—"M.I.C.C. Lighting, Power, Heating and Thermocouple Cables." G. E. D. Redman. Guild House, Worple Rd., Wimbledon, 8.15 p.m.

A.S.E.E. (Manchester Branch).—Film on "Wire Ropes." Engineers' Club, Albert Sq., 7.30 p.m.

A.S.E.E. (Coventry Branch).—"Ductube," by representative of Ductube Co., Ltd. Technical College (Room A.5), 7.15 p.m.

INCORP. PLANT ENGRS. (Kent Branch).—"Earths and Protective Earthing of Electrical Plant." W. J. Jones. Bull Hotel, Rochester, 7 p.m.

EXHIBITION DIARY

Welsh Indus. Fair. Opened yesterday, New Pavilion, Sophia Gdns., Cardiff. Closes Sept. 20.

Exbn. of Street Lighting. Held in conjunc. with A.P.L.E. annl. conf. at Harrogate, Sept. 16 to 20.

International Machine Tool Exbn. Opens Olympia Sept. 17, closes Oct. 4.

N. West. Business Efficiency Exbn. Opens St. George's Hall, Liverpool, Sept. 22 until Sept. 27.

Internat. Comm. Motor Transport Exbn. 16th show opens Earls Court, London, Sept. 26, closes Oct. 4.

1952 Minibition. Org. by Purchasing Officers' Assoc. to run concurrently with their Nat. Conf. at Harrogate between Oct. 2 and 5.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons, Ltd., 116 Chancery Lane, London W.C.2.

J. H. D. Bolton (Electrics) Ltd. Electricians, and radio and television repairers, etc. Nom. cap.: £200. Dir.: J. H. D. Bolton, address not stated. Subs.: Jean Herbert and Claire Moore, 128 Albany St., N.W.1.

British Lead Alloys Ltd. To acquire those parts of undertakings of British Lead Mills, Ltd., and British Copper Tubes, Ltd., which relates to refining of scrap lead and the manufacture of lead alloys, etc. Nom. cap.: £100. Dirs.: to be appointed by subs. Subs.: H. North and W. G. Popkin, 5, Upper Belgrave St., S.W.1.

Brownell Ltd., Dart St. Works, Dart St., W.10. Electrical equipment specialists, etc. Nom. cap.: £1,000. Dirs.: A. V. J. Browning and S. C. Elwell.

H. R. Electric Motors (Newhaven) Ltd., Bridge Works, The Island, Newhaven, Sussex. Nom. cap.: £1,500. Dirs.: A. G. Hughes and F. W. Reeves.

Enthoven Solders Ltd., 89 Upper Thames St., E.C.4. Nom. cap.: £1,000. Dirs.: A. Trebucq, K. L. Cobb and W. J. Myers.

F. and N. Fieldsend and Partners Ltd., 11 Albert Sq., Manchester, 2. Representatives and general agents, brokers and trustees for civil, electrical and general engineers etc. Nom. cap.: £1,000. Dirs.: F. C. Fieldsend and Mrs. N. Fieldsend, and J. J. Lopian.

Filtavac Ltd., 64a Kensington Church St., W.8. Manufacturers of and dealers in industrial and domestic vacuum-cleaning apparatus, etc. Nom. cap.: £200. Dirs.: A. M. Nehorai and Annie McKeown.

Motor Winding Co. Ltd., 18 Gipsy Hill, S.E.19. To take over business carried on at Gipsy Hill, S.E.19, By Geo. W. Howard, Chas. T. Kilian and John F. Palmer. Nom. cap.: £500. Dirs.: G. W. Howard, C. T. Kilian and J. F. Palmer.

Wilfred Pemberton (Avonmouth) Ltd., 96 Bute St., Cardiff. Electricians, engineers, contractors, dealers in electrical equipment, etc. Nom. cap.: £2,000. Dirs.: W. Pemberton, J. C. Lindley and H. Storm.

Triune Engineering Co. Ltd., 31 Forest Side, Worcester Park, Surrey. Sheet metal workers, turners, welders, electrical engineers, etc. Nom. cap.: £1,000. Dirs.: V. G. Combe and May G. Combe.

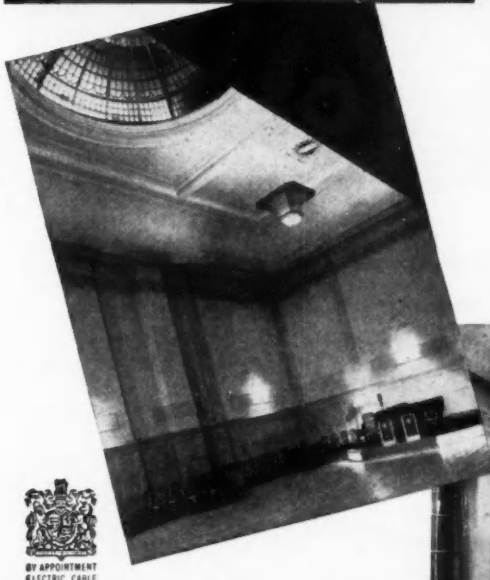
Architects: Tiltman & Howard, F.F.R.I.B.A., 38 East Street, Brighton, 1.

FAMOUS CABLES for a FAMOUS HOTEL

To improve the electrical services in Brighton's famous Grand Hotel, the building has been completely re-wired. This work also involved additional cable runs for the ballroom, and the new reception suite shown in the lower pictures.

Henley Cables and Wires totalling 72 miles were used for the contract, which was carried out by

H. J. GALLIERS
32, St. James Street, Brighton, 1.

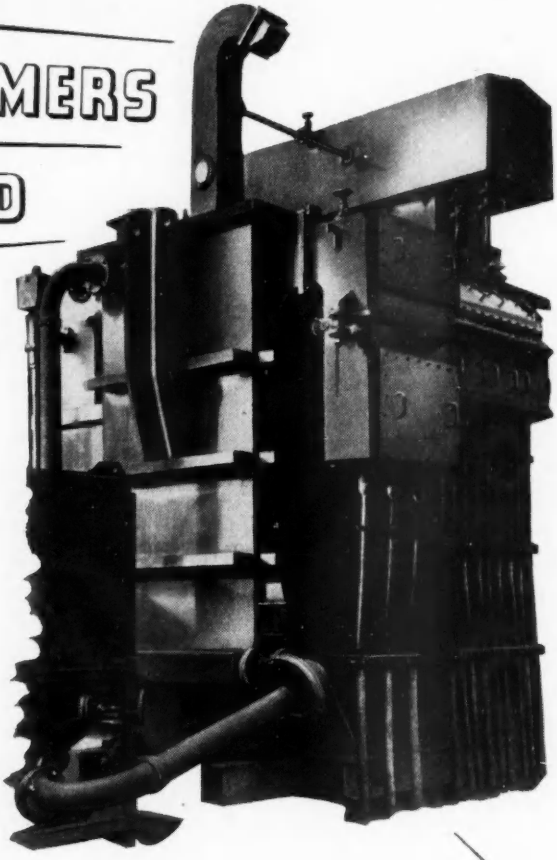


HENLEY CABLES

BY APPOINTMENT ELECTRIC CABLE MANUFACTURERS

W. T. HENLEY'S TELEGRAPH WORKS CO. LTD., 51/53 HATTON GARDEN, LONDON, E.C.1.

TRANSFORMERS OF PROVED MERIT



WE SPECIALISE in manufacturing Power Transformers for Generation, Transmission and Distribution

ALL YORKSHIRE Transformers are entirely manufactured in our own works. We make Transformers to suit all requirements up to 60,000 k.V.A.-132,000 volts

YORKSHIRE YET **TRANSFORMERS**

YORKSHIRE ELECTRIC TRANSFORMER CO., LTD., THORNHILL, DEWSBURY, YORKSHIRE
Phone: Dewsbury 1691/2

CLASSIFIED ADVERTISEMENTS

OFFICIAL TENDERS AND APPOINTMENTS

WANTED • FOR SALE WORK WANTED

Those wishing to advertise in these pages should send the text to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London W.C.2, before 10 a.m. on TUESDAY of week of issue. Official Displayed Advertisements are charged at 42s. per inch, and all other classified advertisements at 3s. per line. Situations Wanted will be published four times for twice the single insertion rate. Fee for Box No. and postage on replies is 2s.

TENDERS INVITED

CITY OF MANCHESTER EDUCATION COMMITTEE

EXTENSION TO THE MUNICIPAL COLLEGE OF TECHNOLOGY

ELECTRICAL ENGINEERING EQUIPMENT

TENDERS are invited for any or all of the following:—Oscillographic equipment. Laboratory instruments, indicating and recording. Decade resistors. Decade condensers. Audio frequency oscillators. Impedance bridge. Galvanometers and shunts. Standard resistors. Standard condensers. D.c. potentiometer. Phase shifter. Relays and test equipment. Wheatstone bridge. Volt box. Transformers. Sliding resistors. Potentiometric equipment. Shunt unit for use with d.c. potentiometer. Portable potentiometer. Variable mutual inductors. Variac transformers.

Tenderers should be familiar with the provisions of Standing Order 76 (a and b) of the Manchester City Council, a copy of which, together with more detailed specifications regarding the above items, may be obtained from the Acting Principal, College of Technology, Manchester 1.

Tenders (in Duplicate) in sealed envelopes endorsed "College of Technology, Electrical Equipment" should be addressed to the Chairman, College of Technology Sub-Committee, Education Offices, Deansgate, Manchester 3, so as to reach him not later than 10 a.m. on Friday, October 3, 1952.

The Committee does not bind itself to accept the lowest or any tender. (B 63)

APPOINTMENTS VACANT

Engagement of persons must be made through a Local Labour Office or Scheduled Employment Agency, if the applicant is a man aged 18-64, *or a woman aged* 18-59; *unless the person concerned is excepted or the employment is in a managerial or professional capacity, or is otherwise excepted from the provisions of the Notification of Vacancies Order*, 1952.

BRITISH ELECTRICITY AUTHORITY

South Wales Division

Vacancy No. 63/52

APPLICATIONS are invited for the following superannuable appointments at the new Uskmouth Power Station, near Newport.

1. ASSISTANT SHIFT CHARGE ENGINEERS, N.J.B. Class "K," Grade 9 (£741 to £771 per annum).

2. STATION SHIFT CONTROL ENGINEER, Class "K," Grade 10 (£699 to £728 per annum).

The classification will eventually be raised to Class "L."

Applicants for these appointments should preferably have served a regular apprenticeship and obtained the Higher National Certificate. Previous experience in a modern power station essential.

Previous applicants for these positions will be reconsidered and need not re-apply.

Forms of application, obtainable from the Divisional Secretary at the address below, should be returned by September 23, 1952.

H. J. BENNETT,
Divisional Controller.

British Electricity Authority,
Cardiff (Pengam Moors) Airport,
Cardiff.
September 2, 1952. (B 58)

CENTRAL ELECTRICITY BOARD FEDERATION OF MALAYA

OPERATION AND EFFICIENCY ENGINEER required by the Central Electricity Board, Federation of Malaya. Option of appointment either (a) on agreement for three years in the first instance leading, subject to satisfactory service, to an offer of permanent employment on the pensionable establishment, with opportunity of terminating appointment at the end of the first year's service if so desired, or (b) on contract for three years with a gratuity on satisfactory completion of final service at the rate of £70 for each completed period of three months' service. Salary (including allowances) payable in local currency equivalent at present Government rate of exchange to £1,687, rising to £2,100 a year. Additional allowances payable to married men according to dependants. Free passages. Liberal leave on full salary. Candidates must have had good power station experience including some years as a Charge Engineer in a modern steam station, and have a knowledge of the principles of combustion, thermal cycles, and heat balances, system control, and the economics of operation. Candidates should preferably be Corporate Members or Graduates of the Institutions of Electrical or Mechanical Engineers or hold an equivalent qualification. Those who are not so qualified would be eligible for salary on a lower scale equivalent to £1,673, rising to £1,862 a year.

Apply at once by letter, stating age, full names in block letters and full particulars of qualifications and experience, and mentioning this paper, to the Crown Agents for the Colonies, 4 Millbank, London, S.W.1, quoting on letter M.28770.B. The Crown Agents cannot undertake to acknowledge all applications and will communicate only with applicants selected for further consideration. (B 66)

SOUTH WESTERN ELECTRICITY BOARD

SECOND ASSISTANT DISTRICT ENGINEER (CONSTRUCTION)

REQUIRED at Bath. Salary £677 per annum (F. 7. N.J.B. Agreement).

Candidates should possess wide experience of all types of constructional work.

Detailed applications to District Manager, South Western Electricity Board, The Old Bridge, Bath, by September 23. (B 68)

CITY OF SALISBURY, SOUTHERN RHODESIA

Electricity Department

VACANCY ELECTRICAL ENGINEER GRADE 1 (INSTALLATION ENGINEER)

Salary Grade £921/12/- by £36 to £1,065/12/-

APPLICATIONS are hereby invited for the post of Electrical Engineer, Grade 1 (Installation Engineer) on the above grade which, with the present cost of living allowance, amounts to £1,105 18s. 5d.-£1,278 14s. 5d., plus children's allowances of £30 per annum for the first child and £24 per annum for the next two children.

Applicants must be a Corporate Member of the Institution of Electrical Engineers, London, and have a minimum of ten years' experience on installation work since qualifying.

Candidates must be thoroughly conversant with designing and estimating for electrical installations in industrial, domestic and public buildings. The successful applicant will be required to assist, generally, with the operation and administration of the Installation Department under the control of the Consumers' Engineer. Those interested should write to the undersigned for statement of further details.

DAVIS AND SOPER, LTD.,
Agents to the City Council of Salisbury.
52 and 54, St. Mary Axe,
London E.C.3.
September 4, 1952. (B 69)

YORKSHIRE ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments:—

No. 4 (Leeds) Sub-Area

SENIOR ASSISTANT ENGINEER
(Meters, Testing & Protection)
(Vacancy No. 94/52)

The successful candidate will be responsible to the Sub-Area Engineer for the administration and control of a Class A Meter Test Room and for the work of the Meters, Testing and Protection Section.

Applicants must have had experience in the commissioning of new equipment and the design, testing and maintenance of protective equipment.

Corporate Membership of the Institution of Electrical Engineers is essential and possession of a degree in Electrical Engineering is desirable.

Salary: N.J.B. Class "K." Grade 4, £1,068/£1,115 per annum.

Applications, stating the above vacancy number, and giving full details of age, qualifications and experience, should be forwarded to the Manager, No. 4 (Leeds) Sub-Area, Yorkshire Electricity Board, Bramhope, Leeds, not later than September 26, 1952.

No. 2 (Huddersfield) Sub-Area

SECOND ASSISTANT ENGINEER
(Meters, Testing & Protection)
(Vacancy No. 90/52)

Applicants should be Corporate Members of the Institution of Electrical Engineers, or possess equivalent qualifications and should have a thorough knowledge and experience of all classes of meter repairing and testing, commissioning and maintenance of protective gear and mains fault location.

Salary: N.J.B. Class "K." Grade 7, £844/£881 per annum.

Applications, stating the above vacancy number, and giving full details of age, qualifications, and experience, should be forwarded to the Manager, No. 2 (Huddersfield) Sub-Area, Yorkshire Electricity Board, Market Street, Huddersfield, not later than September 26, 1952.

No. 1 (Bradford) Sub-Area

THIRD ASSISTANT ENGINEER
(Distribution Design)
(Vacancy No. 94/52)

Applicants should possess technical qualifications equivalent to those for Corporate Membership of the Institution of Electrical Engineers and have experience in the planning and design and estimating of medium and high voltage Overhead and Underground distribution systems. They must have experience in the construction and maintenance of such systems.

Salary: N.J.B. Class "K." Grade 10, £699/£728 per annum.

Applications, stating the above vacancy number, and giving full details of age, qualifications, and experience, should be forwarded to the Manager, No. 1 (Bradford) Sub-Area, Yorkshire Electricity Board, 45-53 Sunbridge Road, Bradford, not later than September 26, 1952.

No. 7 (Grimsby) Sub-Area

CONSUMERS' ENGINEER
Scunthorpe District
(Vacancy No. 95/52)

Applicants should be Corporate Members of the Institution of Electrical Engineers and should have had a sound training and experience in the work of a Consumers' Department in an Electricity undertaking. They should have had experience in negotiations with Consumers requiring electricity supplies, tariffs, sales development, application of I.E.E. wiring regulations, other relevant regulations in testing and inspecting consumers' installations, electrical installation work including preparation of specifications and tenders, electrical maintenance workshop, control of staff and workpeople.

Salary: N.J.B. Class "F." Grade 8, £615/£644 per annum.

Applications, stating the above vacancy number, and giving full details of age, qualifications, and experience, should be forwarded to the Manager, No. 7 (Grimsby) Sub-Area, Yorkshire Electricity Board, Moss Road, Grimsby, not later than September 26, 1952.

No. 5 (Wakefield) Sub-Area

GENERAL ASSISTANT DISTRICT ENGINEER
Castleford District
(Vacancy No. 95/52)

Applicants should have had experience in a large undertaking employing e.h.v. and l.v. underground mains. Experience in fault location, the supervision of jointing, cable laying and the erection of overhead lines, would be an advantage.

Salary: N.J.B. Class "E." Grade 11, £504/£521 per annum.

Applications, stating the above vacancy number, and giving full details of age, qualifications, and experience, should be forwarded to the Manager, No. 5 (Wakefield) Sub-Area, Yorkshire Electricity Board, 1a Denby Dale Road, Wakefield, not later than September 26, 1952.

(B 67)

SOUTHERN ELECTRICITY BOARD

ASSISTANT ENGINEER (MAINS MAINTENANCE)

SWINDON District, of No. 2 (Newbury) Sub-Area. Salary N.J.B. Class "E," Grade 9, Column 1 (£567 per annum). N.J.B. conditions of service.

The qualifications required are an approved technical training and experience of similar works, including fault location, and the duties of the post are to assist the operation and maintenance engineer, principally with the operation and maintenance of the H.V. and L.V. overhead and underground distribution systems working at voltages up to 33,000, and to undertake minor mains construction work. Standby duties are involved.

The successful candidate will be required to contribute to the B.E.A. and Area Boards' Superannuation Scheme, if eligible.

Applications on forms obtainable from the Sub-Area Secretary, 7 Oxford Road, Newbury, and returned to him in envelopes suitably endorsed, not later than September 22, 1952.

F. W. KEMPTON,
Secretary.

September 11, 1952. (B 86)

BRITISH ELECTRICITY AUTHORITY

Midlands Division

ASSISTANT CHEMIST is required in the Analytical Section of the Divisional Laboratory, Birmingham. N.J.B. service conditions, superannuable appointment, salary in accordance with Schedule "C," Grade 5, commencing in the range £629 to £765, ultimately rising to £834 per annum.

Applicants should possess a university degree or A.R.I.C., and be thoroughly experienced in general analytical chemistry, particularly relating to water, fuel, and oil, and should be capable of carrying out analysis of complex materials and development of analytical methods.

Application forms available from the Establishments Officer, 53 Wake Green Road, Moseley, Birmingham 13, to be completed and returned by September 27, 1952.

F. W. LAWTON,
Divisional Controller.
(B 70)

THE UNIVERSITY OF SHEFFIELD

APPLICATIONS are invited for the post of LECTURER in Electrical Engineering, to begin duties on January 1, 1953.

Salary scale, £550 by £50 to £1,100, with Superannuation provision under the F.S.S.U. and a family allowance. The commencing salary will depend on the qualifications and experience of the successful candidate. Preference will be given to candidates with experience in Electronics or Communications Engineering.

Applications (four copies) including the names and addresses of three referees, and, if desired, copies of testimonials, should reach the undersigned (from whom further particulars may be obtained) not later than October 11, 1952.

A. W. CHAPMAN,
Registrar.
(B 64)

BRITISH ELECTRICITY AUTHORITY

Southern Division

APPLICATIONS are invited for a position as MAINTENANCE ENGINEER (MECHANICAL) at Earley Generating Station, Reading.

Applicants should have a wide experience in the maintenance of generating station power plant, and be capable of taking control of a large maintenance staff, and machine shop, and supervising turbine and boiler overhauls. Preference will be given to those who are Corporate Members of a recognised professional institution, or have equivalent qualifications. Housing accommodation may be available for the successful applicant. Salary N.J.B. G/6. £762 to £793.

Application forms, obtainable from P. D. A. Oliver, Esq., Divisional Secretary, 111 High Street, Portsmouth, should be returned by September 24, 1952. (B 82)

BRITISH ELECTRICITY AUTHORITY

Southern Division

APPLICATIONS are invited for an appointment as SHIFT CHARGE ENGINEER at Poole Generating Station, Dorset. Applicants should be in possession of technical qualifications admitting to corporate membership of a recognised professional institution, have had previous experience in a large modern generating station, and preferably have had experience of a modern station with high temperatures and pressures, and pulverised fuel equipment. Salary N.J.B. H/7. £747 to £778.

Application forms, obtainable from P. D. A. Oliver, Esq., Divisional Secretary, 111 High Street, Portsmouth, should be returned by September 24, 1952. (B 81)

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

South Caledonia Area

DISTRIBUTION ENGINEER AND ASSISTANT AREA MANAGER

APPLICATIONS are invited for this post. Extensive experience required in the supply of electricity over a wide area. Ability to design, construct and maintain distribution networks (rural and urban), E.H.T. lines and substations up to 33 kV, essential. Experience desirable in the operation and maintenance of 132 kV lines and substations. Candidates should be fully qualified up to the standard of Corporate Membership of the I.E.E.

Starting salary £1,100 per annum, but additional remuneration for special qualifications and experience will be considered. Superannuation scheme applicable.

Applications, marked "Confidential," should be made upon application forms obtainable from the undersigned.

A. GRANT, B.Sc., M.I.E.E.,
Area Manager.

Blackfriars,
Perth. (B 88)

BRITISH ELECTRICITY AUTHORITY

Midlands Division

ASSISTANT SHIFT CHARGE ENGINEER is required at Stourport Generating Station. N.J.B. service conditions, superannuable appointment, salary in accordance with Class "J," Grade 9, commencing at £699 per annum.

Applicants should preferably possess the Higher National Certificate in Mechanical or Electrical Engineering, or an equivalent qualification, and should have received sound technical training and practical experience in the operation of a large power station.

Application forms available from the Establishments Officer, 53 Wake Green Road, Moseley, Birmingham 13, and should be completed and returned not later than September 27, 1952.

F. W. LAWTON,
Divisional Controller.
(B 87)

KENT COUNTY COUNCIL

APPLICATIONS are invited for appointment in the Buildings Department of an ENGINEERING ASSISTANT (ELECTRICAL) in A.P.T. Grades IV to V (£555 to £645).

Applicants must be Graduate Members of the Institution of Electrical Engineers with good experience in the preparation of schemes, specifications and estimates for all classes of electrical installation work.

Applications, on forms obtainable from the County Architect, Springfield, Maidstone, must be delivered to him within fourteen days of the appearance of this advertisement.

W. L. PLATTS,
Clerk of the County Council.

County Hall, Maidstone.
September 1, 1952. (B 57)

BRITISH ELECTRICITY AUTHORITY

South Western Division

JUNIOR ENGINEER required in the Maintenance Section of the Transmission Department at Divisional Headquarters, Bristol.

Superannuation scheme. Salary N.J.B. Class "AX/CX," Grade 9, £375-£505/£525-£536.

Knowledge of 132 kV overhead line and substation equipment would be an advantage. H.N.C. Electrical or equivalent qualification desirable.

Apply by September 19, 1952, stating age, qualifications, experience, present appointment and salary, to R. C. Barrett, Divisional Secretary, 26 Oakfield Road, Bristol 8. (B 89)

BRITISH ELECTRICITY AUTHORITY

South Eastern Division

GENERAL ASSISTANT ENGINEER, Divisional Technical Engineer's Department based at Brighton. Applicants should possess H.N.C. in Electrical Engineering, or equivalent and should preferably have a knowledge of automatic protective gear. N.J.B. conditions. Salary, Class "AX," Grade 8, £401 to £619 per annum. Applications on forms obtainable from Establishments Officer, British Electricity House, Lower Ham Road, Kingston-on-Thames, Surrey, to be received not later than September 22, 1952. (B 84)

BRITISH ELECTRICITY AUTHORITY

North Western Division

VACANCY No. 785. ASSISTANT SHIFT CHARGE ENGINEER, Westwood Generating Station, Wigan. Salary £621-£648 (N.J.B. G.9).

Apply, quoting vacancy No., to Establishments Officer, British Electricity House, 825 Wilmslow Road, Manchester 20, before September 20. (B 65)

BRITISH ELECTRICITY AUTHORITY

London Division

APPLICATIONS are invited for the following superannuable posts. Salary, including London Allowance, and conditions of service in accordance with N.J.B. Schedule A.

ASSISTANT SHIFT CHARGE ENGINEER
Barking A and B Generating Stations

Qualifications: sound technical training preferably to Higher National Certificate standard and practical experience in control and operation of plant in modern generating station, including P.F. and chain grate boilers, turbines up to 75 MW, control room experience, and experience in control of personnel. Salary—Class "M," Grade 9, equals £879 18s. p.a.

BOILER HOUSE SUPERINTENDENT
Taylors Lane Generating Station

Qualifications: sound mechanical and electrical training with first class technical background. Wide experience necessary in efficient operation and maintenance of large modern generating plant and auxiliary equipment, together with ability to plan and organise work to a strict time schedule. Experience in operation and maintenance of extra high-pressure boiler plant an advantage. Salary—Class "F," Grade 6, equals £748 13s. p.a.

SHIFT CHARGE ENGINEER
Blackwall Point Generating Station

Qualifications: sound technical training in electrical and mechanical engineering, and at least two years practical experience in operation of modern high pressure turbine and boiler plant, preferably with P.F. firing equipment. Salary—Class "F," Grade 7, equals £710 17s. p.a.

STATION SHIFT CONTROL ENGINEER
Blackwall Point Generating Station

Qualifications: up to Higher National Certificate standard or equivalent, together with sound technical training, and should have had practical experience in the control and operation of large generating plant and E.H.T. switchgear. Salary—Class "F," Grade 10, equals £584 17s. p.a.

Applications, stating age, qualifications and experience, to Divisional Secretary, B.E.A. London Division, Ergon House, Horseferry Road, S.W.1, within 14 days of this advertisement. (B 85)

NORTH WESTERN ELECTRICITY BOARD

APPOINTMENT OF
(a) THIRD ASSISTANT ENGINEER (TESTING),
(b) GENERAL ASSISTANT ENGINEER (TESTING)
Technical Engineer's Section, Chief Engineer's Department, Area Board Headquarters, Manchester

DUTIES for post (a) will include testing of all types of equipment used on a distribution system. Experience in h.v. testing, including impulse testing, would be an advantage. Applicants should hold the H.N.C. in Electrical Engineering or its equivalent.

Duties for post (b) include general testing of equipment used on a distribution system. Applicants should be of H.N.C. standard and have experience in testing work.

Salary scales: Post (a) Within range £629/858 p.a., Grade AX/EX 5;

Post (b) Within range £481/694 p.a., Grade AX/EX 8. N.J.B. conditions.

Applications to Establishment Officer, The North Western Electricity Board, Cheetwood Road, Manchester 8, by September 20, 1952.

APPOINTMENT OF
(a) SENIOR DRAUGHTSMAN, Blackpool
(b) ENGINEERING DRAUGHTSMAN, Fleetwood

Applicants should preferably have experience in the preparation of plans for new and existing buildings, electrical network diagrams, and the layout and construction of sub-stations. The possession of a Technical Certificate in Electrical or Mechanical Engineering will be an advantage.

Applicants for the senior post should be capable of taking charge of a Drawing Office.

Salary scales: Post (a) £547/651 p.a. Schedule "D," Grade 5.

Post (b) £413/547 p.a. Schedule "D," Grade 6.

N.J.B. conditions.

Applications to Sub-Area Manager, No. 4 Sub-Area, The North Western Electricity Board, 40/41 Lune Street, Preston, by September 20, 1952. (B 71)

AN ELECTRICAL DESIGNER, having several years drawing office experience and extensive practical knowledge of l.v. switchgear, small machines and wiring, is needed on a range of attractive projects for feeding the drawing office with design information and clearing production problems. H.N.C. an advantage.—Please write, giving full details and quoting 1017, to Central Personnel Services, English Electric Co. Ltd., 24-30 Gillingham Street, London S.W.1. (B 24)

MIDLANDS ELECTRICITY BOARD

DISTRICT SENIOR CLERK required for the Stroud District of the Central Gloucestershire Sub-Area. Duties involve the control of consumers' records and associated matters, contracting, Costing and invoicing, payment of wages, meter reading and general clerical and stores work of a district office. Salary £560 to £620 (N.J.C., Grade 4).

Apply, in writing, within 14 days, stating age, experience, salary and position, to: Sub-Area Manager, Midlands Electricity Board, 126 London Road, Gloucester.

A. STEPHENS,
Secretary.
(B 83)

A FULLY SKILLED ARMATURE WINDER for repair shop. Top rate, bonus, 5-day week, and all holidays paid, etc.—The Lewis Electric Company, Moor Works, Blackamoor Lane, Maidenhead. (A 703)

APPLICATIONS are invited for the following three appointments: DESIGNER DRAUGHTSMAN for automatic control gear and L.V. switchgear. Knowledge of flameproof gear an advantage. Higher National Certificate essential. DRAUGHTSMAN, junior, with experience in industrial switch and control gear. Preferably with National Certificate. JUNIOR CONTRACT ENGINEER with switch or control gear experience and National Certificated. Good working conditions, pension scheme, assistance with housing to married men after a probationary period.—Write, stating age, experience, qualifications and salary required. Wallacetown Engineering Co. Ltd., Ayr, Scotland. (B 6)

BRITISH ELECTRICITY AUTHORITY—Transmission Construction. SECOND ASSISTANT ENGINEER required at Operational Headquarters, Bankside, to prepare specifications, report on tenders and co-ordinate 132 kV construction work involving visits to sites. Candidates with qualifications not below A.M.I.E.E. standard should have experience in this work, particularly 132 kV and lower voltage switchgear. Experience of site work and co-ordination of transmission schemes from inception to completion, is desirable. Salary N.J.B., Grade 3, £814 to £1,184 inclusive.

Applications, which will be acknowledged, should be made on forms obtainable from D. Moffat, Director of Establishments, British Electricity House, Great Portland Street, London, W.1, and returned not later than September 29, 1952. Quote reference AE/288. (B 73)

DESIGN and development. ASSISTANT to chief designer required by switchgear manufacturers in South West England. Draughtsman with good mechanical and electrical knowledge, and preferably with previous experience of medium voltage switchgear development. Applicants should be 25/35 years of age, and should have National Certificate or equivalent. Progressive and permanent position with good salary for man with initiative.—Box No. 1967, Electrical Times. (A 707)

DRAUGHTSMEN required for the preparation of maps and plans of overhead and underground mains. 5-day week. Salary according to age and/or experience.—Write, giving age, experience and qualifications, to Manager, Eastern Electricity Board, Northmet House, Southgate, N.14. (B 75)

ELECTRICAL DRAUGHTSMAN required for large iron and steel works in the North West. Must be experienced in work's sub-station layout, h.t. and l.t. distribution systems, lighting layouts, etc.—Apply, giving details of age, training, experience and technical qualifications to Box No. 2001, Electrical Times. (B 59)

ELECTRICAL DRAUGHTSMEN required for lighting installations and power distribution layouts for industrial plants. London office; pension scheme; 5-day week.—Write full particulars, age, qualifications and experience to Box 6152, c/o Charles Barker and Sons Ltd., 31 Budge Row, London, E.C.4. (B 47)

ELECTRICAL ENGINEER. Applications invited by Malayan Collieries from young, single qualified men with some experience of mining equipment and ability to train apprentices in elementary electrical and mechanical engineering. Salary dependent on qualifications and experience. Contract 3 to 3½ years. Passages paid. Free accommodation. Provident fund. C.O.L. bonus. Six months leave on full pay on completion of contract with further employment if mutually satisfactory.—Apply to W. H. Loxley and Co. (London) Ltd., Plantation House, Fenchurch Street, London E.C.3. (B 60)

ESTIMATOR (JUNIOR) required by electrical manufacturers dealing with specialised motors and generators. Preferably with test bed experience. London district. State experience, age and salary required.—Box No. 1981, Electrical Times. (B 22)

BOX No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London W.C.2

Engagement of persons must be made through a Local Labour Office or Scheduled Employment Agency, if the applicant is a man aged 18-64, or a woman aged 18-59; unless the person concerned is excepted or the employment is in a managerial or professional capacity, or is otherwise excepted from the provisions of the Notification of Vacancies Order, 1952.

EWBANK & PARTNERS, LTD., have a vacancy for a qualified ELECTRICAL ENGINEER who must have had experience in the preparation of specifications, estimates and contract documents and is competent to take charge of large engineering contracts from the design stage through to the completion of work at site.—Applications in writing, stating age and giving full details of training and experience, should be addressed to the Secretary, Ewbank & Partners, Ltd., 10-11 Grosvenor Place, London, S.W.1. (B 74)

HANDLEY PAGE (Reading) LTD., The Aerodrome, Woodley, Reading, have a vacancy in their Design Office for a SENIOR AIRCRAFT ELECTRICAL DRAUGHTSMAN. They have an interesting project in hand and the post is progressive and offers good scope for advancement to the right man.—Please send full particulars to the Personnel Officer. (B 21)

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MACHINES AND CONTROL GEAR ENGINEER required by the Steel Company of Wales Ltd., for their Electrical Development Department. Applicants must have had design experience with a leading manufacturer, preferably engaged on electrical equipment for iron and steel works, and should possess an electrical engineering degree or equivalent.—Applications should be addressed to: The Personnel Superintendent, The Steel Company of Wales Ltd., Box No. 3, Port Talbot, Glam. (B 5)

MANAGER required for cable factory producing rubber and plastic cables. Must be very strict disciplinarian and an expert practical man. Accommodation provided.—Write, stating age, experience and salary required. Box No. 1999, Electrical Times. (B 54)

PILKINGTON BROS., LTD., Glass Manufacturers, require ASSISTANT ELECTRICAL ENGINEERS (not over 30 years of age), for large electrical plants in the north of England.

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Applications should be addressed to the Chief Personnel Officer, Pilkington Bros., Ltd., St. Helens, Lancashire. (B 72)

PIRELLI-GENERAL CABLE WORKS LTD., have vacancies for experienced ENGINEERS to supervise erection of steel tower and wood pole transmission lines.—Write, giving experience, age and salary expected, to Overhead Lines Department, Eastleigh, Hants. (B 19)

REPRESENTATIVE, preferably experienced, needed for North Eastern Counties by well-known manufacturer of electrical appliances. Applicants should possess car and be resident in the area. Good basic salary, commission and expenses.—Box No. 2009, Electrical Times. (B 94)

SENIOR DRAUGHTSMAN required for work on Electrical Power Resistances and large electric heaters for industrial applications. Previous experience on this class of work desirable but not essential.—Apply by letter with full details including age, technical qualifications, whether married or single, and salary required, to Box No. 1965, Electrical Times. (A 706)

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(35/38) required for small cable works. Previous experience and proved ability in progressive management essential. Commencing salary £1,000 per annum. Full details, in confidence, please, to:

Box No. 1995, Electrical Times. (B 52p)

SALES MANAGER

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Box No. 1997, Electrical Times. (B 53p)

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Tel.: EASt 3161.

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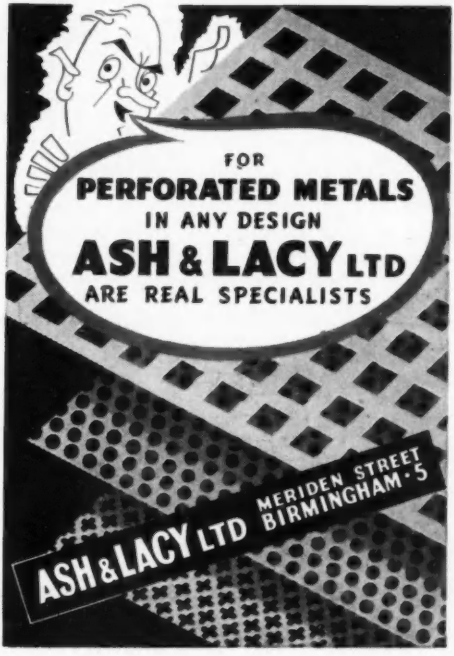

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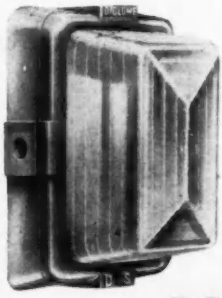

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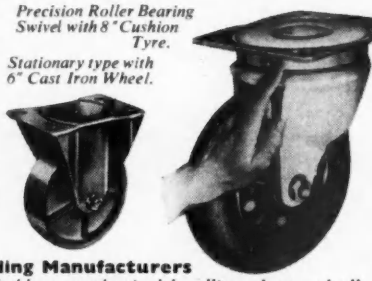

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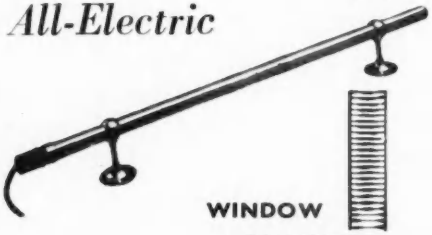

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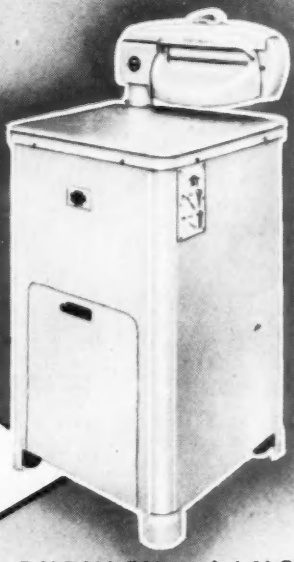

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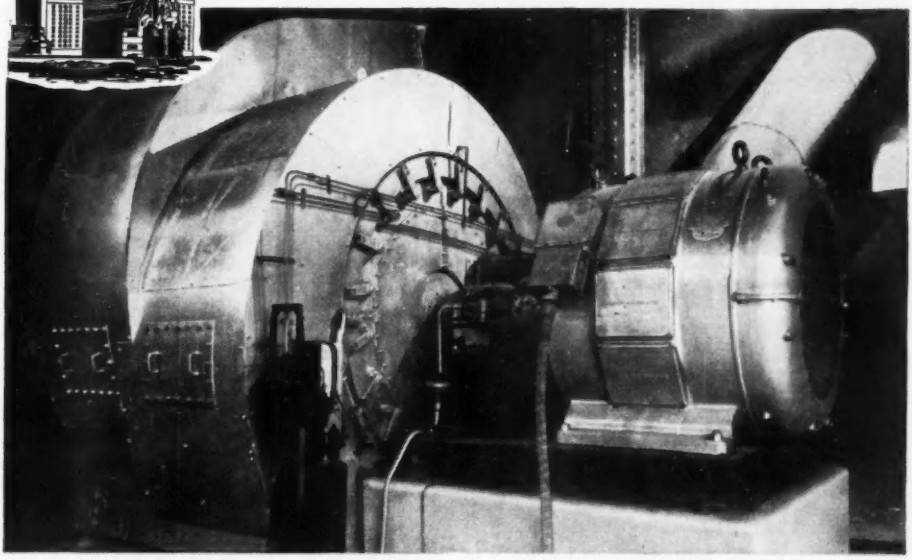

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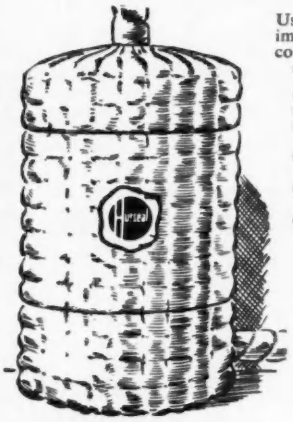

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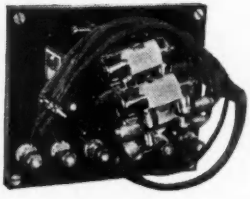

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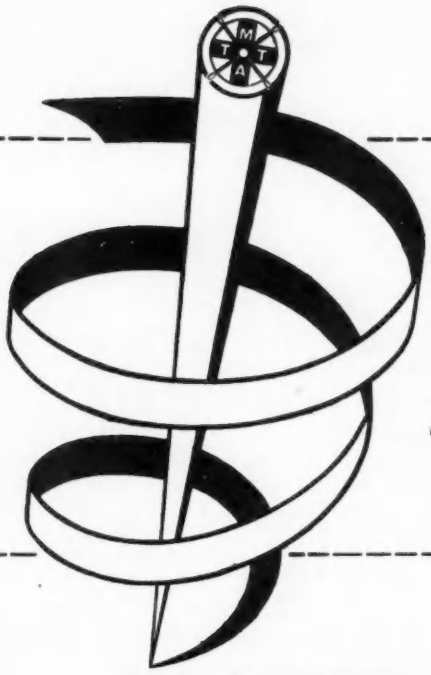

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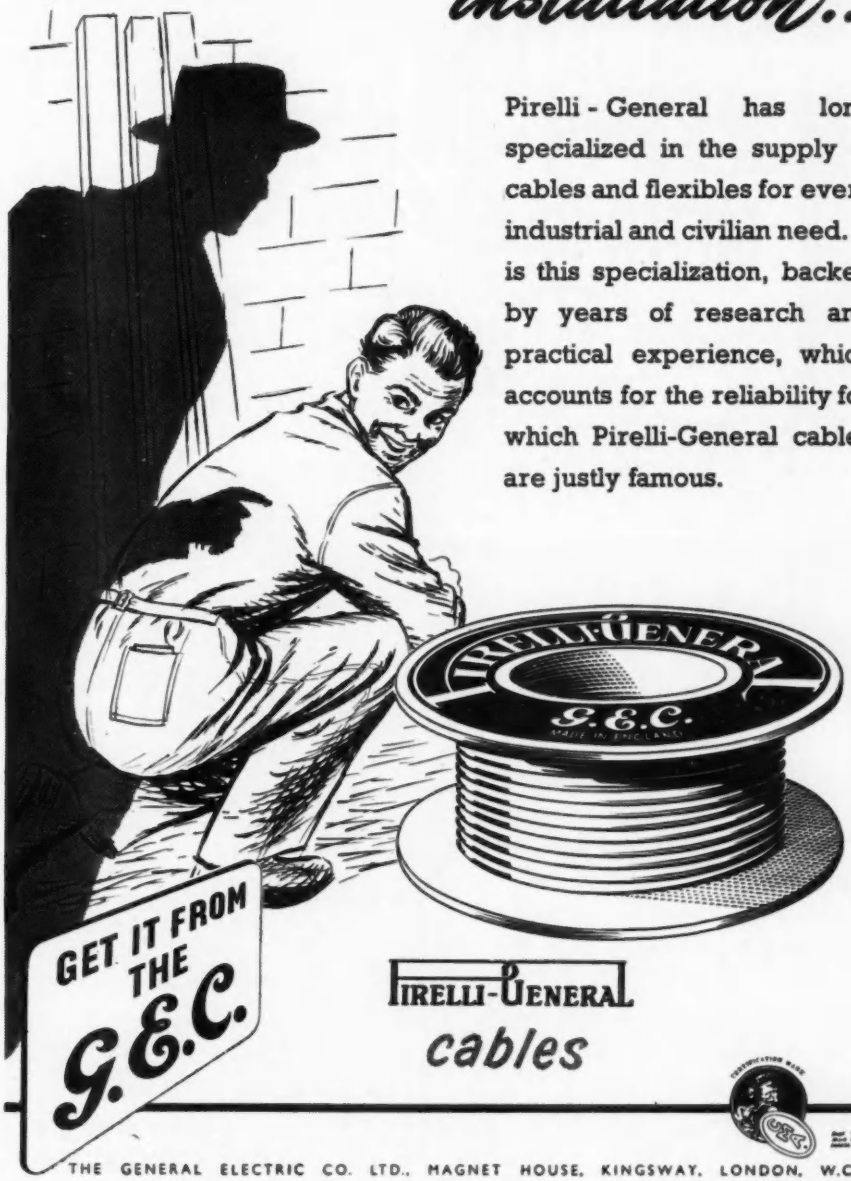

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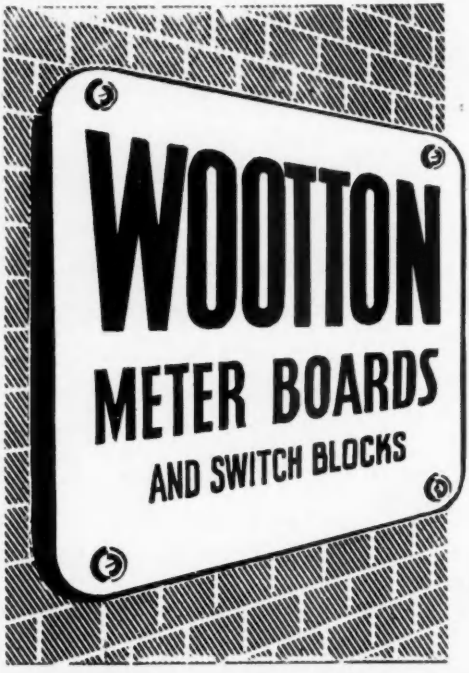

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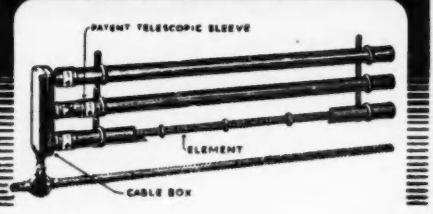

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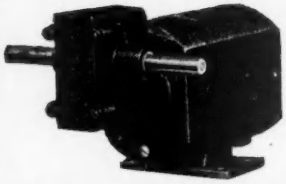

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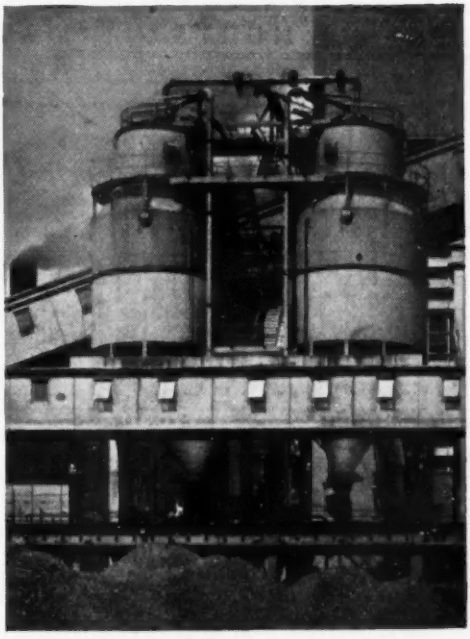

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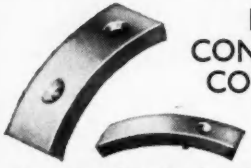

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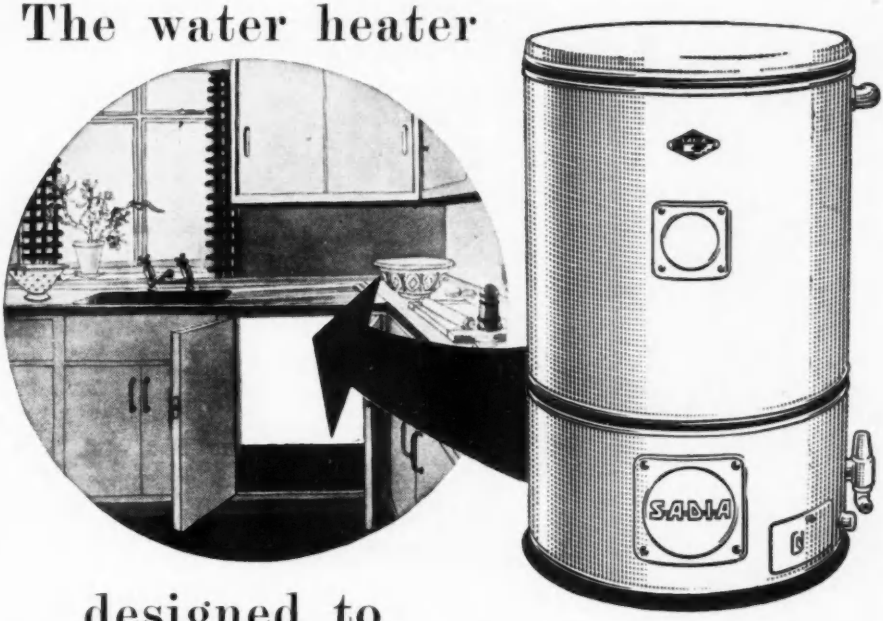

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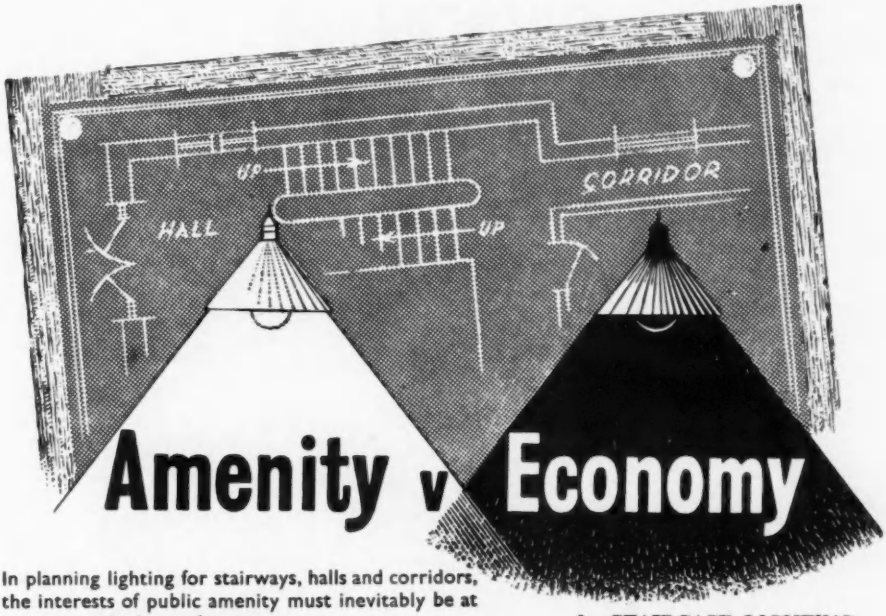

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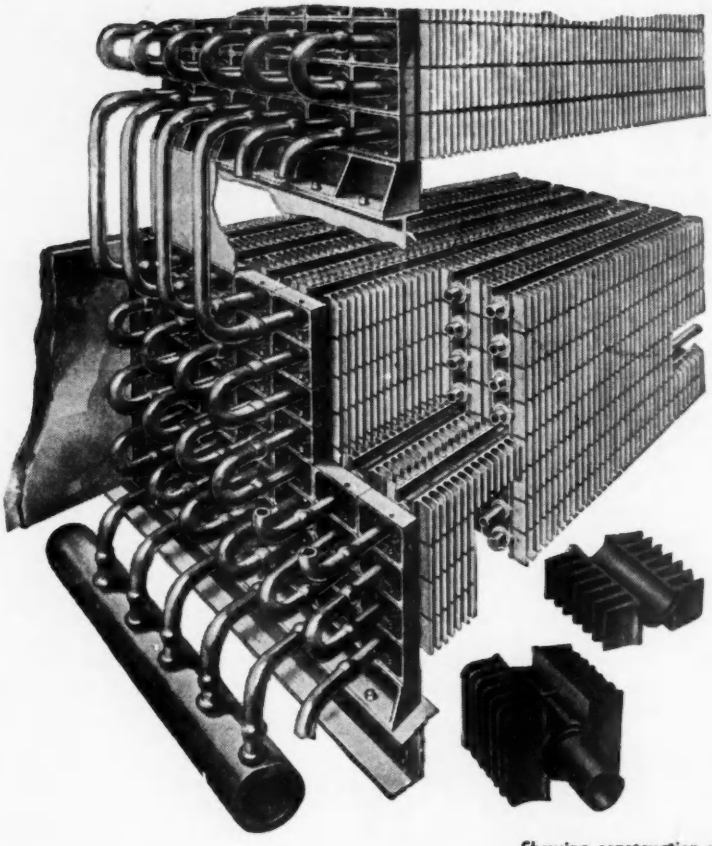

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CERAM TYPE CSK

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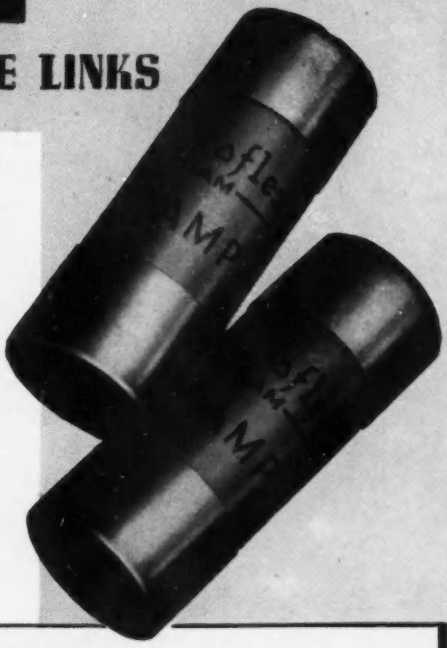

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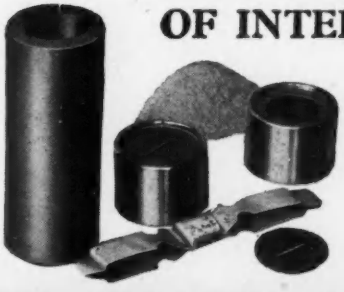

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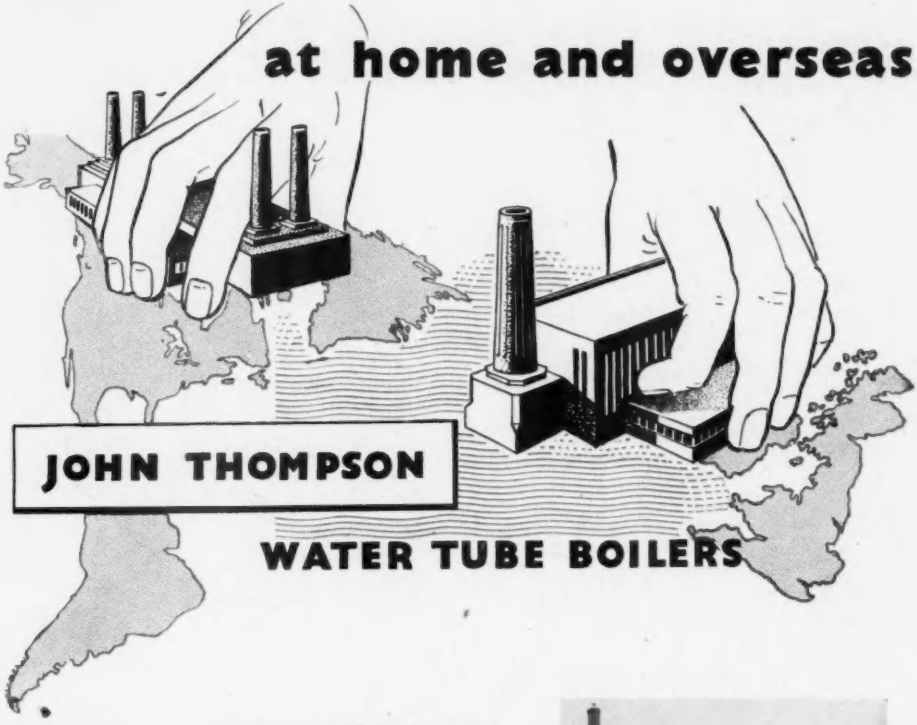

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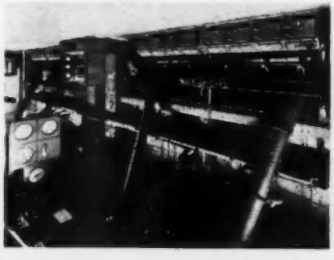

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